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CIVIL ENGINEERING

SPACED TOP AND BOTTOM CHORDS of 130-ft arch trusses are joined to web members by connectors and bolts in mold loft building of Kaiser-Vancouver shipbuilding plant. See articles pages 30 and 40.

Pick-Sloan Plan Develops Resources of Missouri River Basin—Freeman

New $6,000,000 Causeway Joins Miami with Nearby Keys—Rader

Clear, Precise Specifications and Contracts Invite Lower Bids—Hills and Lovan

Building Research Advisory Board Aids Building Industry—Tatlow

JACKSONVILLE MEETING DIVISION REPORTS—Page 13

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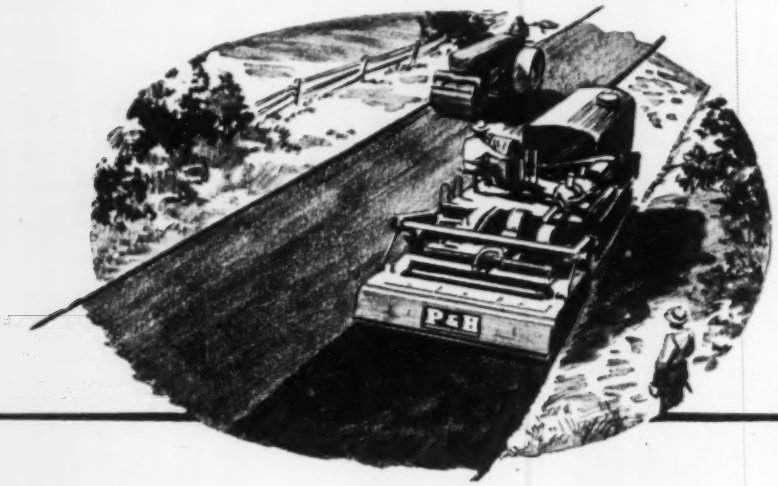

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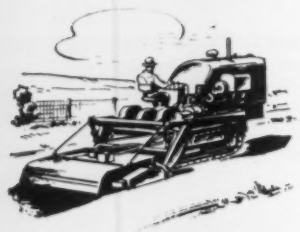

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Two borrow soils, sand and light clay, were combined and mixed with 4% of RO4 (cut back asphalt) to a depth of 6" in a single operation. The P&H Single Pass Stabilizer's average production was 1264 square yards per hour while processing an 18 foot roadway in two nine foot lines — over a mile of roadway per day of 8½ hours.

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Structural Division Presents Outstanding Series of Papers on Timber

at ASCE Fall Meeting in Jacksonville, Fla.

SUBJECTS OF particular interest to the South highlighted the seven Technical Division sessions at the Fall Meeting of ASCE in Jacksonville, October 15 and 16.

A symposium on tidal rivers, conducted by the Waterways Division Wednesday afternoon, was based on studies of the Savannah and St. John's Rivers, and the use of hydraulic models in solving the problems in tidal rivers.

Another symposium was conducted Wednesday afternoon and again Thursday morning by the Structural Division. This one, on structural timber, was prepared under the direction of the Division's Committee on Timber Structures.

The Sanitary Engineering Division also held two sessions, one Thursday morning and another the same afternoon. Papers presented centered on sanitary engineering developments in the South, including water and sewage treatment.

The City Planning and Highway Divisions had a combined session Thursday afternoon. The Construction Division also conducted a meeting Thursday afternoon at which subjects of vital interest to the construction industry were discussed. The three papers presented at this session are published in this issue of CIVIL ENGINEERING.

Committee on Timber Structures Sponsors Symposium Presented at Structural Session

EIGHT PAPERS were presented and discussed in a two-session symposium on structural timber presented before the Structural Division under sponsorship of the Division's Committee on Timber Structures. Professor Jewell M. Garrelts, Columbia University, secretary of the Division's executive committee, presided.

W. H. O'Brien, Southern Pine Association, New Orleans, had a paper on "Grades and Grading of Structural Timbers," which was delivered by A. D. Freas, member of the engineering research staff of the U. S. Forest Products Laboratory, Madison, Wis.; and R. P. A. Johnson, chief, timber mechanics, Forest Products Laboratory, Madison, Wis., presented a paper on "Research Development in Timber Mechanics." Other authors of papers presented at the first-day meeting were Frank J. Hanrahan, National Lumber Manufacturers' Association, Washington, D.C., who discussed "Postwar Timber Design, Construction and Working Stresses," and E. George Stern, associate research professor and head of the department of wood construction at Virginia Polytechnic Institute, Blacksburg, Va., who spoke on "European Developments in Timber Design and Construction."

Frank J. Hanrahan

The specter of deforestation, enhanced by accelerated wartime uses of wood, was dispelled by Mr. Hanrahan, who not only stated there will be "an ample supply of forest resources for all foreseeable needs," but that war-fostered design specifications, which assign to timber a greater load than ever before, assure adequate structures, and make wood construction even more economical than it was previously." An article based on the paper presented by Mr. Hanrahan appears on page 30 of this issue of CIVIL ENGINEERING.

E. George Stern

Outstanding developments in the field of wood construction, made by neutral European countries throughout the war years, may prove helpful to American civil engineers, Mr. Stern declared, adding: "Knowledge of the findings made in outstanding European developments in timber design and construction may prove helpful to the engineer active in the field of wood construction, although the economy and efficiency of some of the design and construction principles involved may be different in the United States from those in the countries of origin. Steel is foreign to the European workman. Labor is cheap. These basic factors govern timber construction in many European countries and have to be given consideration when it is determined whether European advances and developments in timber design and construction can be advantageously applied in this country."

Using photographs, Professor Stern analyzed the more recent developments, many of them emanating from Switzerland. Among the subjects on which he touched were the following wood construction methods: Saw-tooth timber splicing by means of high-frequency heat application; investigations on nailed timber joints; studies of timber-connector joint efficiency; wood beams and floors of composite constructions; nailed wood-frame constructions; standard timber-girder bridge units; timber falsework; and wood subflooring for highway bridges.

An article by Mr. Stern on "Modern European Practice Promotes Economic Use of Timber Structures" was published in the April 1947 issue of CIVIL ENGINEERING.

At the second day's session, a paper on "Stress Distribution in Timber About Split-Ring Timber Connectors," by Prof. A. G. H. Dietz and Prof. Frank J. Mehringer, both of Massachusetts Institute of Technology, was presented. J. H. Carr, Jr., Timber Engineering Co., Washington, D.C., presented a paper on "Connector Research and Findings." Ralph H. Mann, American Wood Preservers' Association, New York City, read his paper, "Wood Waterfront Structures," and Prof. Howard J. Hansen, acting head of the Industrial Engineering Department, University of Florida, Gainesville, presented a paper, "Teaching Timber Mechanics and Design."

Howard J. Hansen

Potential economies offered by recent developments in timber mechanics make the modernization of

engineering courses to include up-to-date studies in wood technology an essential step in the public interest, Professor Hansen said.

"Unless the student is given adequate instruction in these materials, the educators of today are neglecting their responsibility," he asserted in emphasizing that technical developments in the use of wood and plywood, many of them war-fostered, have made it possible to design with the same degree of accuracy and efficiency as in other materials.

Professor Hansen outlined the University of Florida's plans for expanding courses in this field, and continued:

"It is unfortunate that the present texts on strength of materials do not devote much space to timber mechanics. Unless the instructor supplements the text material, the student will be inadequately and, in many cases, incorrectly informed.

"Wood has reached a place of prominence in the construction industry, and it will continue to be an important structural material. How, then, can we neglect to give it proper space in our engineering curricula today?"

A detailed account of Professor Hansen's paper is included in an article on page 40 of this issue of CIVIL ENGINEERING.

Tidal River Phenomena Discussed in Symposium Before Waterways Division

THREE papers were presented in the Waterways Division's symposium on tidal rivers, at a session over which W. W. DeBerard, Chicago, chairman of the Division's executive committee, presided. Authors of papers were: Ralph F. Rhodes, principal engineer, U.S. Engineer Office, Savannah, Ga., whose subject was "General Theory of Tidal River Phenomena as Illustrated by the Savannah River"; Harold A. Scott, chief, Multiple Purpose Section, U.S. Engineer Office, Jacksonville, who presented a paper on "The St. John's River Tidal Problems"; and Henry B. Simmons, engineer, Waterways Experiment Station, Corps of Engineers, Vicksburg, whose subject was "The Use of Hydraulic Models in the Solution of Problems in Tidal Rivers."

Ralph F. Rhodes

How civil engineers are conserving the energies of tidal waves to compel tidal rivers to maintain their own channels, with resultant savings through reduction in required dredging, was narrated by Mr. Rhodes.

"All the hydraulic phenomena which occur in the tidal section of a river are the results of the entrance through the mouth of a wave produced by an influx of water from the ocean," Mr. Rhodes concluded in his paper covering more than a quarter-century of study and which, he said, he hoped would be helpful to engineers in other parts of the world who are being called upon to design and construct harbor and shipping facilities in connection with the opening up of new commercial territory.

"The wave has energy, measured by its volume and its rate of propagation upstream. As it travels upstream, it gradually loses its initial energy, principally in overcoming the friction of the stream bed and banks and the force of the fresh-water discharge moving downstream from the upper watershed. The velocity of propagation of the wave is increased by increasing the depth of the channel, and this increase in velocity increases the length of the wave. Removing obstructions in the channel, such as abrupt variations in depth and width, sand bars, shoals, and the like, preserves the range of tide or increases it and thus maintains or increases the vertical dimension of the wave. The length of the wave and its height, together with its velocity of propagation, measure its energy, and on this depends the amount of work the river may be called on to do in maintaining its channel or increasing its size."

With charts, Mr. Rhodes illustrated how channel improvements over a 14-year period had speeded up the Savannah River tidal wave crest from 10.8 mph to 21.7 mph, and said, regarding such efforts to compel the river to make its own bed:

"The amount of work that the wave will do in the river and the distance from the mouth at which the work is done depends on how well the channel designer conserves the energy of the wave as it passes upstream. This conservation is accomplished by confining the run of the tide to one single continuous channel and removing all channel obstructions which use up the energy of the wave uselessly. In designing an improvement in the tidal section of a river consisting of a channel which should be self-maintaining to as great an extent as practicable, the energy of the wave should be conserved by making the channel in which it runs continuous, without tributaries or diversions, and by removing from this channel all obstructions to the free movement of the tidal wave. Velocities in currents are derived from the energy remaining in the wave, and are the forces which the designing engineer has to consider in making channel designs and on which the maintenance engineer depends for keeping the channels open."

Henry B. Simmons

Use of models of tidal rivers and harbors pays dividends, through reduced dredging maintenance costs, Mr. Simmons brought out in his paper. Shoaling was cut virtually in half at an annual saving of $67,000 in one instance reported by Mr. Simmons, who told how hydrographic and topographic conditions, tidal heights, current velocities, and salinity are reproduced.

"Reproduction of tidal phenomena requires that the model be constructed exactly to scale ratios," Mr. Simmons said. "Therefore, the acquisition of accurate prototype surveys for the construction of the model is essential.

"Accurate reproduction of the rise and fall of the tide in the model and of the resulting flood and ebb tidal currents requires a very precise and constantly changing flow of water into and out of the model to an exact time scale. Improved electrical equipment, which controls the required rates of flow automatically, and thus eliminates personal error which manual manipulation once entailed, now consistently reproduces tides in a model with a fine degree of accuracy."

Mr. Simmons described the models, some constructed to linear scale ratios of 1 to 1,000 horizontally and 1 to 150 vertically, and explained how roughness is produced in the models by using stucco and small gravel arranged so that current velocities and distribution of flow conform to prototype equivalents. Some of the simulated river beds, he pointed out, are movable.

One of the model studies discussed by Mr. Simmons in his paper was that of Deepwater Point Range in the Delaware River.

"At the time of the model study," he said, "the range shoaled at an average rate of approximately 2,800,000 cu yd annually, requiring almost continuous dredging to maintain project depth. The heavy shoaling was due,

according to extensive studies, to lack of parallelism between the currents and the channel. In the model study, tides were controlled by automatic tide reproducers at the two ends of the model, and the roughness value of the model channels was so adjusted that tides and current velocities and directions were reproduced accurately. Shoaling also was reproduced through injection of simulated shoaling material, both upstream from the problem area during the ebb tide period and downstream during the flood tide period."

The plan recommended for solution of the Delaware shoaling problem called for construction of a dike to realign the currents, based on model indications that a reduction in shoaling of 47 per cent was attainable. A 3½-year study immediately following the construction of the dike showed a reduction in shoaling of 48 percent from the average rate before construction of the dike, or just a trifle more efficiency than was indicated by the model study, Mr. Simmons said.

"Taking into account the initial costs of the structure, interest thereon, cost of maintenance, and the additional cost of dredging in another section of the river, where slightly increased shoaling occurred following construction of the dike, as against the cost of dredging material which would be deposited except for the dike, the actual monetary saving amounts to approximately $67,000 annually," Mr. Simmons asserted.

Emphasizing that the hydraulic model is not a "cure-all" for problems in tidal rivers and harbors, Mr. Simmons pointed out that models provide an excellent means for comparing the effectiveness of various types of improvement works, and in many instances reveal undesirable hydraulic characteristics of a proposed improvement plan that could not be detected by other means.

"Several instances could be cited," he said, "in which extensive investigations of prototype problems by means of model studies indicated that a practical and economical plan for solution of the problem could not be devised. Even in such instances, however, the models have proved valuable to the extent that expenditure of funds for proposed improvement works which would have proved ineffective, was prevented."

Problems of the South Are Discussed at Two Sanitary Engineering Sessions

SIX PAPERS, dealing largely with Southern problems and developments in the field of sanitary engineering were discussed at two meetings of the Sanitary Engineering Division, over which John H. O'Neill, New Orleans, member of the Division's executive committee, presided. Richard Hazen, consulting engineer, of New York City, presented a paper written jointly with Malcolm Pirnie, New York, Past-President of ASCE, entitled, "A Review of Water Treatment in Southern United States," at the Thursday morning session. Others on the program were Claude F. Wertz, resident engineer, Day & Zimmerman, Inc., Miami, whose subject was "Lime Recovery in Miami Water Plant," and Charles Richheimer, of the consulting engineering firm of Reynolds, Smith & Hills, Jacksonville, who spoke on "Seawater Regeneration of Zeolite Water Treatment Plants."

Malcolm Pirnie and Richard Hazen

Quality of water supply and its treatment in eight urban areas along the southeastern Atlantic Coast was the subject of the paper prepared by Malcolm Pirnie and Richard Hazen of New York, who have had recent contact with water supply installations in these areas. The paper was presented by Richard Hazen.

Five of the installations described are in Florida—at Key West, Miami and St. Petersburg, which are supplied from groundwater sources; at West Palm Beach where surface water is collected by a canal system; and at Jacksonville, supplied from artesian wells. The three other systems discussed are those of Savannah, Ga., where deep wells are used, supplemented by water from the Savannah River; and of Charleston, S.C., and Wilmington, N.C., both of which take their water from adjacent rivers.

Salt water intrusion in many coastal areas dependent on groundwater has created a serious problem, the authors of the paper pointed out. At Wilmington this condition, resulting from channel improvements between the city and the mouth of the Cape Fear River, has been overcome by building a pipeline over 20 miles long to carry water from a new filter plant erected at the pool above the first lock. Miami, similarly menaced by lowering of the groundwater table as a result of construction of sea-level drainage canals, storm-water drains and high pumpage from wells, has overcome the danger of intrusion by inaugurating an additional supply program that includes controlling water levels in drainage canals.

Jacksonville, supplied from the great Ocala limestone groundwater reservoir, has had no substantial change in source of supply, the speaker said. Its artesian pressure system rises from under a 500-ft blanket of clay and can be tapped at almost any point in the city at a depth of from 600 to 1,200 ft. Sulfates are present varying from 150 to 100 ppm in Jacksonville to 6 to 14 ppm 16 miles from the city. St. Petersburg also takes its water from the Ocala-Tampa groundwater reservoir near Cosme and is supplied through a 36-in. main 39 miles long from a softening and filtration plant in operation since 1935.

Surface water collected by a canal system and stored in shallow reservoirs is the source of supply at West Palm Beach. Because of high coloration, well water of 150 ppm bicarbonate alkalinity is added prior to coagulation. Heavy prechlorination is now being tried out, said Mr. Hazen and means are being installed for tests on raw waters of varying quality.

Deep wells have been the main source of water in Savannah, but a deep depression cone in the artesian head has increased the possibility of salt-water intrusion. The authorities propose to draw on the waters of the Savannah River for industrial and domestic use and are now building a low-level pumping station and filter plant of 35 mgd initial capacity on the river some 16 miles above the city. At Charleston, where the plant consists only of settling basins and gravity filters, a soft colored water is drawn from the Edisto River, connected with Goose Creek Reservoir by a 20-mile tunnel.

In view of variations in quality of water in southeastern areas, the authors of the paper urged engineers first to determine the best source available for economical development and to give "sound advice as to methods of preventing overdevelopment of a limited source of supply and adverse encroachment of land and waterway developments."

Claude F. Wertz

That old saw about fighting fire with fire is being emulated by civil engineers who are combating one kind of lime with another in producing

softened water and, by means of a relatively new recovery process, are winding up with enough salvaged lime to eliminate purchases and have some left over to sell. All of which adds up to substantial savings and better service for taxpayers, it was brought out in the paper by Mr. Wertz.

Mr. Wertz described a lime-recovery plant now under construction for the City of Miami as one "which will not only take care of all its lime requirements during the next 15 or 20 years, but will produce an excess the first 10 years which can be sold." On an investment of just over half a million dollars, he said, annual savings of $84,000 will be effected, which will pay off the total investment in from six to seven years, not taking into account "additional profit from the sale of some 8,000 tons of lime produced over and above requirements."

In the process of softening Miami's water from a total hardness of 260 ppm to 80 ppm, most of the hardness has been found to be due to calcium bicarbonate, a form of lime, and to offset one kind of lime, another has been used — quicklime — imported from Tennessee, Missouri, and Arkansas, Mr. Wertz said.

He described the plant and equipment being built and installed for recovery of lime from the resultant sludge through a process on which initial experiments in the United States were conducted less than 10 years ago, and asserted that, although final cost, estimated at about $550,000, will be nearly twice that originally contemplated when the project was proposed in 1944, savings anticipated from repeated use of the salvaged lime have prompted Miami to proceed.

"In addition to the saving in overall cost of producing a softened water, the availability of an abundant supply of lime at all times will permit the delivery of properly softened water 365 days in each year, which has not been possible during the past few years," Mr. Wertz declared. "Records for the first seven months of 1947 indicate that the hardness of the water exceeded 100 ppm on 83 days, or 39 percent of the time."

At the Thursday afternoon session, Clarence Sterling, chief engineer, Health and Sanitation Division, Office of Inter-American Affairs, Washington, D.C., discussed "Pan American and South American Developments in Sanitary Engineering." C. D. Williams, head professor of civil engineering, University of Florida, Gainesville, and David B. Lee, chief sanitary engineer, Florida State Board of Health, Tallahassee, coauthored a paper, "Developments of Sanitary Engineering Research Facilities in Florida." The third paper of the afternoon was by W. A. Moggio, research associate, Engineering Experiment Station, Louisiana State University, Baton Rouge. His subject was "The Program of the National Council for Stream Improvement for Pollution Abatement in the South."

C. D. Williams, David B. Lee

An auxiliary sewage treatment plant at the University of Florida, necessitated by unprecedented postwar enrolments, will double as a research laboratory seeking data expected to "affect the economy and efficiency of sewage treatment in Florida, as well as throughout the country," it was brought out in the paper by Professor Williams and Mr. Lee, whose organizations are cooperating on the research project.

Although nearly 50 million dollars in new sewage treatment and collection systems work is in the various stages of planning for Florida, and plans were approved last year for more than 11 million dollars of such projects, the paper pointed out that only 12 percent of the state's urban population or less than 8 percent of the entire population, is connected to modern sewage treatment units. Florida's 225 communities with populations of more than 250, only three of which have more than 100,000 population, contain 63 percent of the state's 2,250,061 persons. The average sewage disposal problem in Florida involves a city of 6,372 population, close to the 6,547 population equivalent being used at the new research lab–sewage treatment plant, based on an enrolment of some 10,000 but allowing for students and faculty living off the campus.

Another parallel was drawn:

"One of the chief industries of the state is to provide for its tourist population during the winter months. The number of persons occupying any urban area fluctuates seasonally. The sewage treatment problem for many cities in Florida is one of treating larger quantities during the winter season than in the summer. Great variations in sewage flow occur at a university. During vacations and holidays the flow is very low. During the summer sessions the flow is much less than in the regular terms. The solution of the problem of treatment of greatly varying flow appears to be in the provision of unit type treatment, permitting the minimum flow to be treated under conditions equivalent to the treatment of the maximum flow. A design has been worked out which permits the treatment of any multiple of 100,000 gpd, up to 700,000."

Although work on the new plant–laboratory is just being completed, having been begun a year ago, "one graduate thesis has been completed and considerable additional data are being collected on the effects of rates of loading on the degree of treatment," as a result of studies conducted at the university.

Planning the Location and Function of Federal-Aid Urban Highways Discussed at Joint Session

PLANNING THE LOCATION and function of federal-aid urban highways was the subject before the joint meeting of the City Planning and Highway Divisions. Charles M. Upham, Washington, D.C., chairman of the Highway Division's executive committee, presided. Papers were presented by W. M. Parker, division engineer of research and records, Florida State Road Department, Tallahassee, who spoke on "The Interstate Highway Through Jacksonville," and E. H. Holmes, chief, Division of Highway Transport Research, Public Roads Administration, Washington, D.C., whose subject was "Travel Habit Surveys for Planning Transportation Systems."

W. M. Parker

Postwar highways "must serve localized urban traffic with the economy and convenience equal to that offered the through traveler," because the supposition that bypasses fulfill the responsibility to urban centers is "not well founded."

This was the gist of Mr. Parker's paper in which he pointed out that, under new laws and with greater public understanding, "federal and state highway engineers are now joined officially and legally with the city traffic engineer in a team to improve the efficiency of urban highway travel."

Calling de-congestion of urban areas swollen with postwar traffic a question not of what can be done, but one of "what must be done," Mr.

Parker cited the proposed $34,500,000 interstate highway through Jacksonville as an example of unified public planning achieved through greater understanding by the public of the need for long-range thinking regarding highways. It was pointed out that, through simplified and brief reports of the studies made, greater public understanding was attained, accompanied by endorsement of the project on a bridge-toll basis, resulting in ability to plan the entire project simultaneously, instead of piecemeal.

Calling on engineers to do "an about-face" in their thinking regarding the virtues of bypassing cities, Mr. Parker pointed out that "only 3,100 trips out of 55,900 recorded in the Jacksonville survey could be classed as bypassable." This, he said, makes it clear that what is needed to "relieve downtown traffic congestion is not bypasses but a limited-access type of street construction, with adequate lane capacity that would facilitate all types of traffic—traffic movements that would not be slowed down by congestion and restrictions such as lights, grade intersections at cross streets, pedestrian movements and the misuse of parking privileges."

To overcome the impracticability of stopping motor vehicle drivers on the congested urban streets for questioning by methods normally used in rural areas, modified versions of procedures used in various public-opinion polls were adopted, Mr. Parker said.

"A 10-percent sample of the dwelling units were preselected by use of city directory, maps and housing records, and trained workers—city school teachers, the majority being principals—were assigned to interview their residents on the zone unit based on the travel performed on the weekday previous to the day of interview. As a supplement to the dwelling unit survey, 20 percent of the truck and taxi operators of the area were interviewed. All interviews were appropriately expanded. When the data were recorded and tabulated, the next step was to measure their reliability. We could not make decisions involving millions of dollars on basic data which were not proven.

Cooperation of Engineers and Contractors Seen as Key to Lower Building Costs

HOW ENGINEERS and contractors can cooperate more closely in efforts to reduce construction costs was discussed in a paper that highlighted the meeting of the Construction Division Thursday afternoon. Professor Elmer K. Timby, head of Princeton University's Civil Engineering Department, a member of the Division's executive committee, presided. George B. Hills of the Jacksonville consulting firm, Reynolds, Smith & Hills, and Charles F. Lovan of the Jacksonville contracting concern, Hillyer & Lovan, coauthored a paper, "Clear, Precise Specifications and Contracts Invite Lower Bids." Mr. Lovan is president of the Northeast Florida Chapter, Associated General Contractors of America, Inc. Two other papers were presented, one by E. M. Rader, Miami, Dade County Engineer, whose paper was entitled, "Construction of the Rickenbacker Causeway," and the other by R. H. Tatlow III, New York City, chairman of the ASCE Construction Division's Committee on Construction Planning, entitled "The Building Research Advisory Board—Its Past and Future," which was read by John F. Reynolds, Jacksonville consulting engineer. All three papers presented before the Construction Division are published in this issue of CIVIL ENGINEERING. Excerpts from the papers are presented in the following reviews.

George B. Hills, Charles F. Lovan

Reduced construction costs are attainable through clear, precise specifications that alleviate the contractor's gamble and make it unnecessary for bidders to allow for maximum conditions which seldom develop, Messrs. Hills and Lovan asserted in their paper. To this end, closer cooperation between owners, engineers and architects, and contractors, was advocated.

"The required degree of cooperative relationship is not at all idealistic," the paper declared. "Rather, the writers regard it as a thoroughly practical and realistic procedure, promising a reduction in project costs and benefits to all concerned, including the interests of the construction industry as a whole."

Decrying insertion of "clauses in the specifications that make the contractor responsible for oversights on the part of the engineer, for any omissions in the plans or specifications, and for unforeseen conditions that may develop during the course of the construction," the authors expressed the opinion that "costs in the industry as a whole will be lowered as such conditions and clauses are omitted from specifications."

E. M. Rader

How an area larger than Miami Beach will be opened for development in Greater Miami, with no financial obligation to taxpayers, was told in Mr. Rader's paper describing the about-to-be-opened $6,000,000 Rickenbacker Causeway.

Key Biscayne, Virginia Key and Fisher Island, which the causeway will link directly with Miami, will add 3,217 acres to the city after improvements are made, compared with Miami Beach's 3,142 acres, Mr. Rader said.

"The financing of the project is entirely on a self-liquidating basis and the bond purchasers will have to look entirely to the revenue produced by the causeway for repayment of funds advanced by them," Mr. Rader said. "Taxpayers of Dade County are not responsible in any manner for the repayment of such funds."

R. H. Tatlow III

Better structures at lower cost must be provided, or the construction industry, already "under fire," will "lose the greatest opportunity in its history," Mr. Tatlow's paper stated.

The Building Research Advisory Board, he said, will have for its overall purpose a program designed "to point the way toward higher quality construction with better service to the public at lower unit costs." It will list, review and correlate the results of research.

A five-year program, to be undertaken with half a million dollars expected to be subscribed by the various segments of the widespread building industry, is contemplated as the initial step in what is expected to be a continuing program, he stated.

"Research in labor-saving devices is urgently needed," he said, and "there is obviously room for much improvement. Unfortunately, improved materials, methods of placement, and other advancements which the Board may develop, will be largely nullified, as far as economy of erection is concerned, unless at the same time restrictive limitations on labor uses and productivity are abandoned. This is one of the industry's greatest problems, in fact one of the nation's most critical problems. The Board must recognize this very real problem even though it is not the proper agency to work on it."

How EJC Accepts Challenge Offered by World Conditions Is Discussed at Jacksonville

HOW THE PROFESSION, through Engineers Joint Council, representing the national societies of the civil, mechanical, mining, electrical and chemical engineers, is accepting the challenge offered by world conditions, was outlined by Malcolm Pirnie, Past-President ASCE, at the opening session of the three-day Fall Meeting of the Society in Jacksonville, Fla.

Pointing out that the engineering profession "has demonstrated that successful prosecution of war is dependent upon its knowledge, wholehearted cooperation and direction," Mr. Pirnie called upon engineers to "prove the corollary that creation of a climate for development of world peace is equally dependent upon the engineering profession."

Leadership already provided by Engineers Joint Council, through preparation of reports on how to disarm Germany and Japan and prevent them from waging future wars, while at the same time restoring them as industrially self-sufficient nations, was cited by Mr. Pirnie. He pointed out also that the Council now has a representative on the United States delegation for UNESCO, the United Nations Educational, Scientific and Cultural Organization.

Such leadership, Mr. Pirnie declared, is needed because, "The United States, transformed from isolationist to world leader in half a dozen years, finds its people inexperienced in approach to their added responsibilities. The relentless, natural law of nature—that all life on this planet must strive to perpetuate itself and, whether animal or vegetable, will kill transgressors of its source of nourishment or space for growth—challenges man to exercise his gift of reason to bring order out of chaos by husbandry of unreasoning animal or vegetable life and by removing the cause of strife among men.

"With more than half the population of the world lacking adequate food, clothing, shelter and individual freedom or knowledge sufficient to create incentive for constructive action to build a more abundant future, there never was a greater challenge to courage, knowledge and leadership than exists today. In the United States, there are about ten million business enterprises. In each there is at least one leader exercising judgment and making decisions upon which rest the success or failure of the enterprise. With such a vast training school for leaders, in which every employee can aspire to the top executive position, there is every reason to expect creditable discharge of the nation's pressing duties."

"Modern Trends in Higher Education" Is Subject of Wednesday Luncheon Speaker

In his talk on "Modern Trends in Higher Education" before members and guests attending the Wednesday luncheon, Dr. Doak S. Campbell, president of Florida State University, stated, "The dependence of institutions of higher learning upon your profession for stimulation and guidance in the development of their educational programs has long been acknowledged."

The speaker further observed that "The developments of the past decade have brought to our citizens quite generally the consciousness of the technological world in which we live. The stupendous achievements of a coordinated military and industrial program are a part of the common understandings of our people. The peculiar economy of the war and postwar era has brought the work of the engineer into a position of importance that it has never before enjoyed. At the same time, the application of the continuous stream of the results of research has made it necessary for the engineer to be constantly revising many of his procedures."

Dr. Campbell stated that even though much of the research upon which the various branches of engineering depend has been taken over by research laboratories of great industries, we are still dependent mainly upon the higher institutions for much of the training in the basic processes of research.

The speaker commented on the deficiency of various mechanical devices used in instruction in shortening the process of developing reflective thinking and in promoting creative imagination.

Dr. Campbell posed the question, "Do we need as many engineers as the present enrollments indicate there will be available after three or four years?"

Shore Problems' Challenge to Engineers Discussed at Thursday Luncheon

Speaking at the Thursday luncheon for members and guests, Dr. Martin A. Mason, principal engineer, Beach Erosion Board, Washington, D.C., explained the engineer's part in handling corrective and preventive action with regard to shore erosion. He stated that by reason of the importance of solutions of the problems, engineers are usually called upon when shore problems become acute.

The speaker stated further that "the cheapest effective shore protection for ocean coastal areas now costs in the neighborhood of $50 per lin ft; dredging of channel shoals with hopper dredges varies widely in cost but prices of about 40 cents per cu yd represent a reasonable figure. Recently a cost estimate of two million dollars per mile of shore was associated with protection of the New Jersey ocean front."

In commenting on failure to solve shore erosion problems even though large sums have been spent on the shore works, the speaker stated that "in the past and today we find engineers handling shore problems as construction jobs not requiring too much skill for their solution. The feeling has been apparently that the accurate determination of what had to be done was subordinate to what the owner desired and would pay for. Engineering skill and knowledge appear to have been expended largely on the structures to be built, with little careful analysis of the shore situation apparent. As a result we have an unenviable record of success in the solution of shore problems."

As an example of faulty corrective measures Dr. Martin cited the work at Palm Beach "where the construction of a protected navigation entrance into Lake Worth ultimately resulted in the loss of beach downcoast, requiring the expenditure of hundreds of thousands of dollars for bulkheads, groins and other structures to save valuable property.

Federal-Aid System Provides Network of Arterial Routes in Urban Areas

PRIOR TO PASSAGE of the Federal-Aid Highway Act of 1944, participation of federal-aid funds in highway improvements in urban areas was limited to extensions of rural federal-aid routes into or through urban areas. The Federal-Aid Highway Act of 1944 makes two main provisions relating to urban road projects:

1. The establishment of urban areas around and including municipalities of 5,000 or more population. Urban areas are not limited to the area within municipal boundaries, but may reach outward to include areas affected by characteristic suburban traffic.

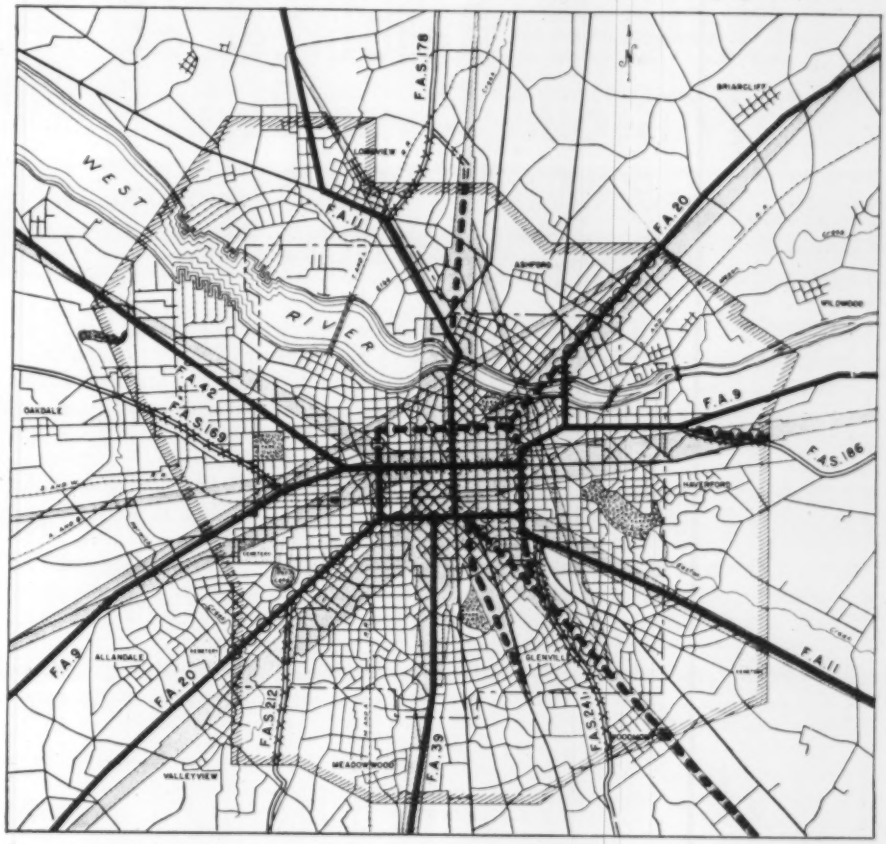
2. The designation of a fund limited to the federal-aid system in urban areas.

A General Administrative Memorandum (No. 318), prepared by Thomas H. MacDonald, Hon. M. ASCE, Commissioner of Public Roads, governs the selection of federal-aid system in urban areas to provide, in municipalities of 5,000 or more population, a comprehensive network of arterials serving the major flow lines of traffic within such areas including terminal routes, and distribution routes serving the federal-aid system lying outside the boundaries of the urban areas. The system is referred to as the urban federal-aid system. A reprint of this memorandum, recently circulated by the American Road Builders' Association, reads as follows:

The system of desirable federal-aid routes in urban areas will be determined by study of all presently approved federal-aid, federal-aid secondary, and state highway system extensions within urban area boundaries, and all other routes of primary arterial significance for the service of traffic within the areas. The system determined shall coincide with lines of travel of greatest importance in the over-all urban highway and street network. In the establishment and continuing development of the urban federal-aid system, it is desired that for each urban area involving urban places of 5,000 or more population a general study be given to the pattern and extent of an ultimate system, and that specific agreement and formal approval be obtained on an interim system which will include important arterials whose early and substantial improvement will be of greatest benefit to the urban area, and whose extent will be sufficient to provide latitude for programming available funds for a period of, say, six to eight years. It is essential that both the ultimate system and the interim system be composed of routes within urban areas conforming to a comprehensive urban development plan of major arterials. Maps are to be maintained and periodically revised showing the ultimate urban federal-aid system.

As a *preliminary step* it is desired that maps of urban areas for each urban place of 5,000 or more population be forwarded to the Washington office,

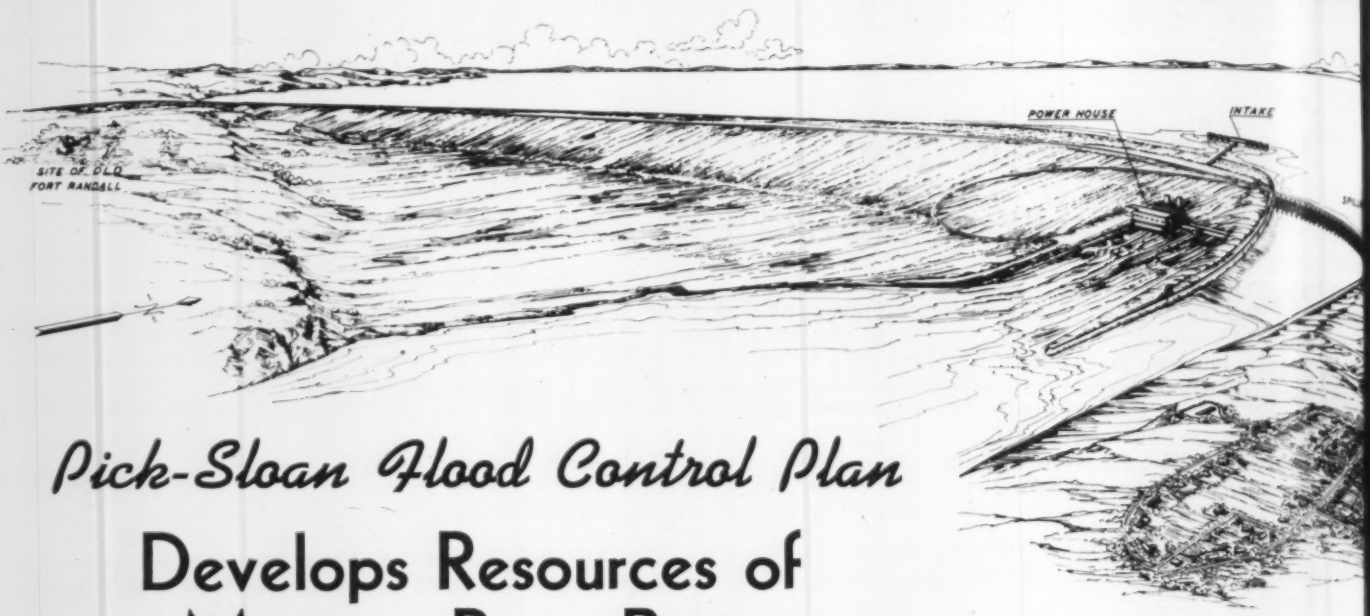
(*Continued on page 86*)



LEGEND

		Mileage within corporation limits	Mileage within urban area
CORPORATE LIMITS			
	ALL STREETS—TOTAL MILEAGE	236.0	340.0
	PRINCIPAL DIRECTIONS OF TRAVEL-DESIRE LINES (Width to scale of traffic if known)	26.0	36.1
	ULTIMATE URBAN FEDERAL-AID SYSTEM:		
URBAN AREA BOUNDARY	Existing federal-aid or urban extensions	13.9	19.9
	Additions	6.1	8.5
	Deletions	2.4	2.4
	Total	17.6	26.0
	INTERIM URBAN FEDERAL-AID SYSTEM:		
	Existing federal-aid or urban extensions	4.3	4.8
	Additions	4.1	4.9
	Total	8.4	9.7
	FEDERAL-AID SECONDARY SYSTEM:		
	Existing federal-aid secondary or urban extensions	1.6	4.5
	Additions	0.0	0.0
Population 190 000 according to 1940 census.	Deletions	1.6	4.5
	Total	0.0	0.0
	EXISTING ARTERIALS—NOT URBAN EXTENSIONS OF FEDERAL-AID OR FEDERAL-AID SECONDARY SYSTEM	6.3	11.0

FEDERAL-AID HIGHWAY ACT of 1944 provides fund limited to federal-aid system in urban areas. Map (above) of typical city shows graphically routes of urban federal-aid system. Symbols also indicate traffic volume.



Pick-Sloan Flood Control Plan

Develops Resources of Missouri River Basin

DELBERT B. FREEMAN, M. ASCE

Lieutenant Colonel, Corps of Engineers; District Engineer, Omaha District, Omaha, Nebr.

DISASTROUS FLOODS throughout the Missouri River Basin in 1943 led to comprehensive studies by the Corps of Engineers—by Congressional directive—of detailed information gathered over the years. These studies were made under direction of General Pick, builder of the Ledo Road in Burma, and at present Division Engineer of the Missouri River Division in Omaha. The "Pick Plan" evolved from these studies, was purposely designed to be a flexible framework to which plans of other agencies could be fitted. The Bureau of Reclamation also prepared a plan referred to as the "Sloan Plan" that supplemented flood control features of the Pick Plan with those of irrigation. The 1944 Flood Control Act consolidates the two plans into what is now known as the Pick-Sloan Plan. This paper presents a discussion of the engineering features of the "Pick-Sloan" plan for development of water resources in the Missouri River Basin for control of destructive floods, improvement for navigation, generation of hydroelectric power, irrigation, water supply and allied beneficial purposes.

EVER SINCE ITS DISCOVERY, the Missouri River has played a vital role in the lives and destinies of the people living within and adjacent to its extensive basin. The river was the main artery of travel and commerce in the development of the Middle West. The history of navigation on the Missouri River generally parallels that of the other great inland streams. Traffic began with the travels of the early explorers, rapidly increased and flourished during the

CONSTRUCTION CAMP at Fort Randall, officially designated as Pickstown, is well under way. Earthfill embankment to be placed in left background will contain 30,000,000 cu yd and will have crest length of almost 2 miles. Dam with maximum height of 160 ft above river channel will impound 6,200,000 acre-ft of water.

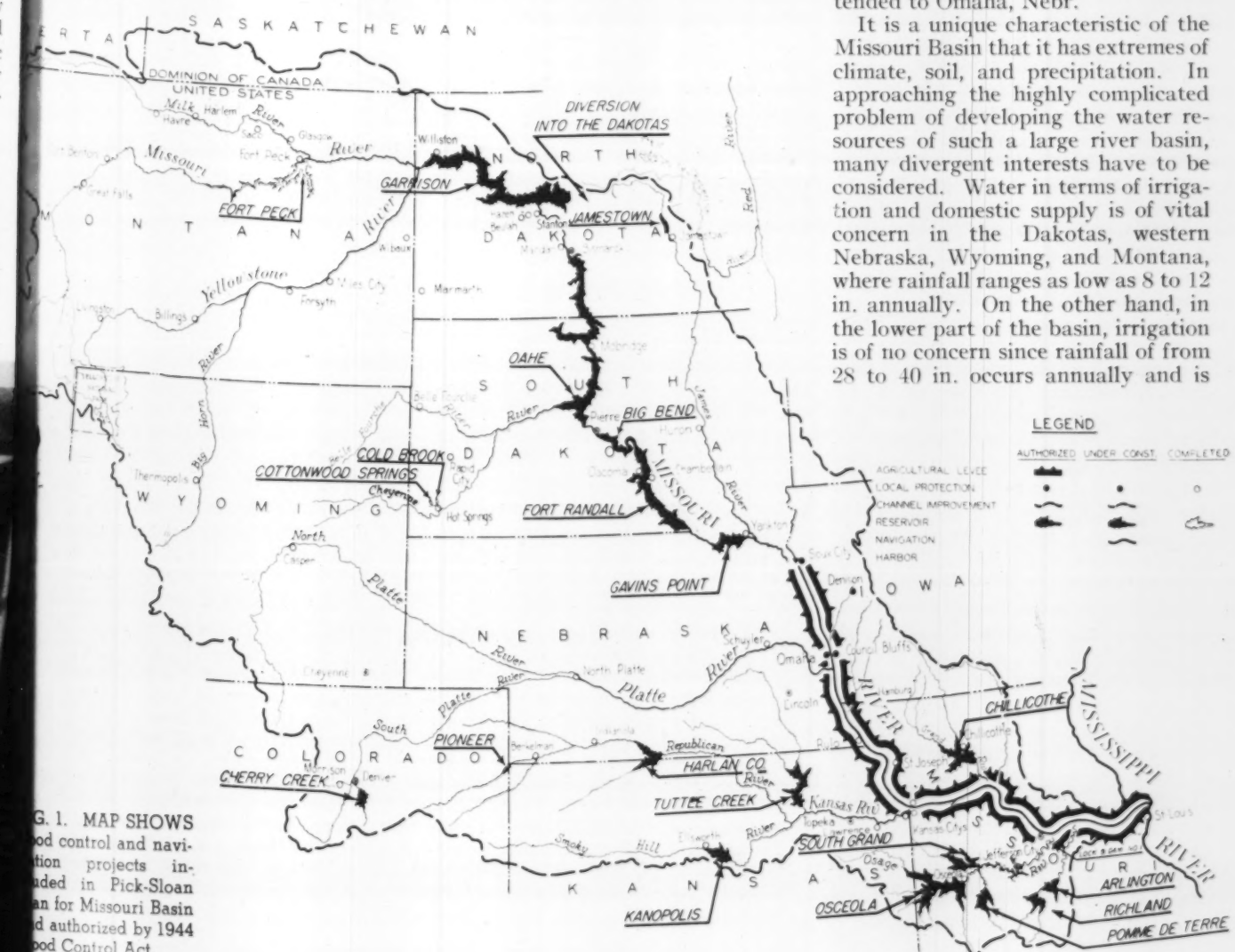
FORT RANDALL DAM, reservoir and damsite in South Dakota comprise second largest main-river project in basin-wide development. Construction features are similar to those of Garrison project, but on smaller scale. Spillway outlet works and powerhouse will require 1,200,000 cu yd of concrete. Initial power facilities will include two 40,000-kw units with provision for increase to eight units.

development of the country, and then declined with the coming of the railroads. Steamboat navigation began on the Missouri in 1819; a commercial line was inaugurated on the lower river in 1829; and by 1831 steamboat navigation extended above Sioux City. In 1867, there were 70 arrivals at Fort Benton, Mont., over 2,200 miles upstream from the mouth. In 1880, the wharf-master's record in St. Louis showed 332 arrivals from, and departures for, the Missouri River.

With the advance of the railroads into the territory, the importance of navigation on the river waned. The last through trip of a commercial steamboat from St. Louis to Fort Benton occurred around 1880, although traffic continued to be of importance for several years thereafter. Navigation on the Missouri River, because of its swift current and tendency to form bars, was always attended with some danger. Although snagging and dredging of the river for navigation have been carried on by the Corps of Engineers since about 1838, it has only been in recent years that sufficient funds have been made available for channel improvement work.

Improvement of the Missouri River from the mouth to Sioux City to provide a navigable channel has been under way about 15 years, but was interrupted by the war. Navigable depths are provided by means of retards, bank revetments, and dikes. Scheduled commercial navigation has been in operation to Kansas City for some time, and has been recently extended to Omaha, Nebr.

It is a unique characteristic of the Missouri Basin that it has extremes of climate, soil, and precipitation. In approaching the highly complicated problem of developing the water resources of such a large river basin, many divergent interests have to be considered. Water in terms of irrigation and domestic supply is of vital concern in the Dakotas, western Nebraska, Wyoming, and Montana, where rainfall ranges as low as 8 to 12 in. annually. On the other hand, in the lower part of the basin, irrigation is of no concern since rainfall of from 28 to 40 in. occurs annually and is



G. 1. MAP SHOWS od control and navi- tion projects in- uded in Pick-Sloan an for Missouri Basin d authorized by 1944 od Control Act.

CONTROL OF DESTRUCTIVE FLOODS in lower river—where as recently as June 1947 flood damages in excess of $100,000,000 were sustained—is important feature of Pick-Sloan Plan. Pictured here, section of earth levee for local flood protection at Omaha, Nebr., is under construction by Corps of Engineers.

ordinarily sufficient to produce crops. But the control of destructive floods in the lower river is of prime importance.

In addition, there is a substantial demand for navigation, development of hydroelectric power, and prevention of bank erosion. Land and water are the two basic factors in the Missouri Valley, and flood and drought the two outstanding problems. In the drought conditions of the 1930's the north and west sections of the basin suffered enormous losses in crops, cattle, and population. The Dakotas lost nearly 90,000 in population and western Nebraska almost 30,000.

Floods have also taken their toll, even as recently as this June 1947, when damages estimated in excess of $100,000,000 were sustained in the lower valley. But these are only tangible losses. No one can measure the loss due to the lack of industrial development in potential areas in cities and towns bordering the streams that are subject to periodic inundation. Nor can an evaluation be made of the toll that has been taken by erosion and destruction of fertile soils. Engineers can appreciate the problems involved in attempting to evaluate such losses.

With the growing realization that water is a limited natural resource in the Missouri Basin, came the aim of basin-wide development, of considering the entire watershed as a natural unit, and formulating plans of improvement for the multiple purposes of flood control, irrigation, navigation, power, prevention of bank erosion, sanitation and pollution abatement, industrial and domestic purposes, recreation, and other beneficial uses. It is apparent that formulation of a plan would devolve upon the two federal agencies vitally concerned with development of water resources—the Corps of Engineers and the Bureau of Reclamation. The experience of the Corps of Engineers on the Missouri River dates from about 1838, and that of the Bureau of Reclamation goes back over 40 years in the arid and semi-arid West.

Two general plans of development were proposed by these two agencies. Urgent requests from various groups throughout the Missouri River Basin were made to Congress following the disastrous floods of 1943 which breached practically every levee that existed along the Missouri River from Sioux City to the mouth. The Corps of Engineers was directed by Congress to investigate the flood situation on the main stem.

Pick Plan Proposed

A comprehensive study based on the detailed information that had been gathered over the years was initiated under the direction of General Pick prior to his assignment to build the famed Ledo Road in Burma during the war. General Pick, now Division Engineer of the Missouri River Division in Omaha, formulated a plan having a multiple-purpose aim covering flood control, irrigation, navigation, hydroelectric power and other beneficial uses of water.

The plan, which became generally known as the "Pick Plan," was incorporated in House Document 475 and was purposely designed to be a flexible framework into which the plans of all other agencies—federal, state, and local—could be fitted. In essence, the Pick Plan provided for a series of levees along each side of the Missouri River from Sioux City to the mouth, supplemented by reservoirs on the main stem above Sioux City and on some of the tributaries.

In accordance with the Congressional directive for the study, the plan was primarily a flood control plan, but also provided for beneficial impounding of flood waters where they could be utilized for irrigation, development of power, and releases to assist in maintaining a stable navigation channel in the main stream.

Bureau of Reclamation Plan

Shortly after the Pick Plan was submitted to Congress, the Bureau of Reclamation, under direction of W. G. Sloan, M. ASCE, completed its studies and evolved a plan generally referred to as the "Sloan Plan," incorporated in Senate Document 191. In keeping with the responsibilities of the Bureau of Reclamation, the Sloan Plan was primarily designed for irrigation, although it likewise provided corollary water use. Consolidation of the two plans was a natural step by Congress in the passage of the 1944 Flood Control Act.

The basin-wide plan, now known as the "Pick-Sloan Plan," as approved by Congress provides for a system of 105 reservoirs and levees in the Missouri River Basin. The Corps of Engineers was authorized to build the structures intended primarily for flood control and navigation; those essentially for irrigation are to be built by the Bureau of Reclamation.

To insure maximum coordination of the federal agencies as well as state

HISTORICAL NOTES

Upon reaching the mouth of the Missouri River in 1673, Marquette and Joliet were amazed to meet a mighty volume of muddy water pouring in from the west. "I have seen nothing more frightful," Marquette wrote. "A mass of large trees . . . real floating islands. They came rushing . . . so impetuously that we could not, without great danger, expose ourselves to pass across." As the first white men to see the Missouri, Marquette and Joliet had witnessed the river in flood.

The territory now included in the Missouri River Basin was acquired by the Louisiana Purchase. Additional information on the territory was the object of the famous Lewis and Clark Expedition which set out to explore the Missouri River, the terrain that it traversed, the peoples encountered, and its natural resources. Lewis and Clark began their expedition from the vicinity of St. Louis in May 1804 and returned in September 1806.

and local interests, the Missouri Basin Inter-agency Committee was established in July 1945 and has functioned through regular monthly meetings rotated among the basin states. It is composed of one representative from each of five federal agencies—the Corps of Engineers, the Department of the Interior, the Department of Agriculture, the Federal Power Commission and the Department of Commerce—with five state governors participating.

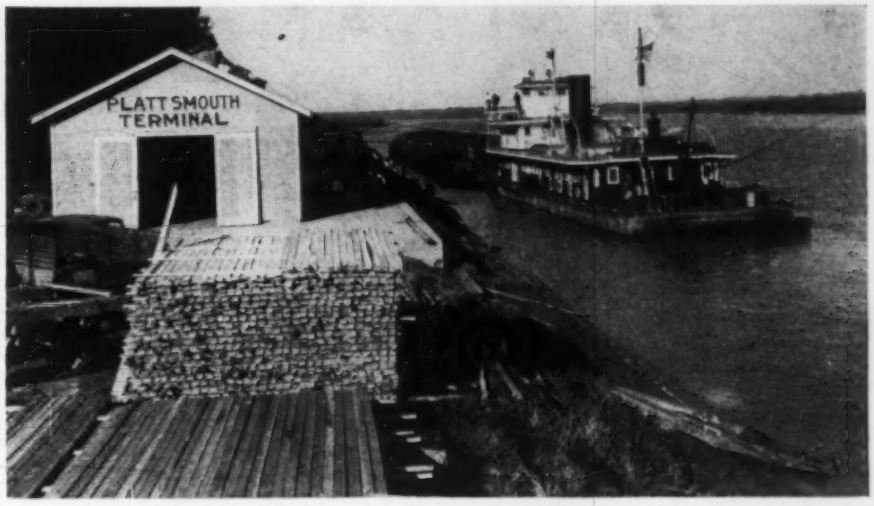
In order to remove the menace of a destructive flood in the lower basin, such as occurred this June, it will be necessary to entirely complete the plan. The high volume of flood waters discharged from some of the tributaries in flash floods must be controlled by reservoirs in order to make it feasible to confine flood runoff within the main-stream levees. The approved plan for the control of the Missouri River and its tributaries, to serve the present needs of the people and to provide an impetus for future development, is a giant engineering project. The entire plan for the Missouri Basin is a great step forward in over-all development and control of water resources in one of the nation's largest river basins. The plan when ultimately accomplished will provide:

First, flood control protection for 1,500,000 acres of fertile farm land along the main channel of the Missouri between Sioux City and the mouth. In addition, protection will be given to such large cities as Sioux City and Council Bluffs, Iowa; Omaha, Nebr.; the Kansas City's and 50 other municipalities. This will result in increased security for agriculture, industry, and commerce.

Second, water will be available to irrigate lands that are now short of adequate supplies and irrigation water will also be provided to an additional $4^1/_2$ million acres in the Great Plains.

Third, by impounding destructive waters during flood seasons and later releasing them at a uniform rate during periods of low water, navigation on both the Missouri and Mississippi Rivers will be stabilized.

Fourth, the large amount of head that will be created by the dams will permit development of incidental low-cost power. The potentialities of the system of reservoirs, operated primarily for the benefit of flood control, irrigation, and navigation will permit the ultimate generation of about 10 billion kilowatt-hours per year. This abundance of power, produced as a by-product, will serve as a stimulant to further economic development in the basin. Power plants will be constructed at each of the five main-stream dams. Initial installations are based on present and immediately forseeable power requirements and aggregate approximately 250,000 kw. Ultimately about 1,000,000 kw will be installed at the 5 authorized dams. Distribution and marketing of this huge block of power will, in accordance with present procedures, be accomplished by the Bureau of Reclamation.



IMPROVEMENT for 9-ft navigable channel from mouth of Missouri River to Sioux City, Iowa, is authorized and under construction by Corps of Engineers. Shown here are terminal facilities for river commerce at Plattsmouth, Nebr., 607 miles above mouth of Missouri River. Inland Barge Line vessel "Franklin D. Roosevelt" is on initial run from St. Louis, Mo., to Omaha, Nebr.

Fifth, other benefits of the plan will be an assured water supply for industrial and domestic use and increased sanitation through alleviation of stream pollution. Facilities will be provided at the reservoirs for public fishing, hunting and boating, which will greatly enhance recreation in a region naturally devoid of lakes.

Engineering Aspects of Plan

During the initial investigations and studies of water utilization, it became apparent that reservoirs on the main stream and tributaries, supplemented by levees, would provide flood protection and full utilization of the river system to satisfy the needs of the entire basin. The area embraced by the Missouri Basin is so extensive that, with its wide variety of climatic and topographic features, floods occur in portions at a time. In the upper and middle reaches, mountain snow melt has produced destructive floods, which, as they passed down the river gradually diminished unless synchronized with rainfall runoff from the lower tributaries. Likewise, rainfall over the lower basin has produced destructive floods with little or no contribution from the upper reaches.

In formulating the basin-wide plan, it was essential that all flood-producing potentialities be considered. After extensive study, it was concluded that a system of reservoirs on the main stream and on some of the tributaries, together with levees and flood walls, was required in a sound technical plan. Either reservoirs or levees alone could not provide the necessary degree of flood protection.

Many engineering questions were involved in the selection of reservoir locations, types of structures, amounts of storage, and heights of levees. Primary considerations dictated that the major reservoirs be located on the upper Missouri with sufficient capacity to impound a maximum amount of water where it is needed for irrigation, development of power, and maintenance of a stable navigation channel, as well as to reduce flood crests on the lower river. Although reservoirs would assure a considerable measure of flood protection, levees are essential for complete protection from flash floods originating in the lower tributaries. Topographic conditions limit levee heights and width of floodway. However, with the control exercised by reservoirs, levees of the practical and moderate height of 10 to 14 ft are feasible.

Of the 105 reservoirs included in the over-all plan, the 5 largest are on the main stem in the Dakotas. These will afford a considerable measure of control all the way down the river to Kansas City, and will influence the required height of levees between Sioux City and the mouth. Pertinent data on these 5 reservoirs, beginning at the upstream end, together with

LOCATED ON LEFT ABUTMENT of Fort Randall Dam, ruins of chapel at old Fort Randall, Army post during early winning of West and Indian wars, will be restored as a point of historical interest.

their storage capacities, are given in Table I. The combined storage capacity of these reservoirs, added to the 19,400,000 acre-ft capacity of the existing Fort Peck Reservoir in Montana, aggregates approximately 70,000,000 acre-ft, or about $3\frac{1}{2}$ times the average annual volume of the Missouri River passing Sioux City, Iowa.

Earthfill Embankments

The physical features at the dam sites and available foundation conditions limited consideration to earthfill embankments at Garrison (May 1947 CIVIL ENGINEERING), Oahe, and Fort Randall. Soil characteristics, as indicated by spillway and outlet works excavations, permit rolled earth embankments. Side slopes vary, generally, from 1 on 10 to 1 on 3 on the upstream and downstream faces of the dams with riprap protection on the upstream slope.

Spillways for the dams will be of the chute type, located on the abutments, and will be of concrete construction. Tentative plans include Tainter crest gates 40 ft long and 29 ft high. Discharge capacities of the spillways are based on maximum probable flood-producing meteorological events, with the resulting flood occurring during full reservoir pool conditions.

Outlet works and powerhouse will be located in the abutments. Studies are also being made of provisions for future navigation locks in the event that investigations now under way indicate the economic feasibility of extending navigation above the currently authorized head of the 9-ft navigation project at Sioux City, Iowa.

Construction has been initiated on the Garrison and Fort Randall projects with funds appropriated by Congress and contracts have been let for construction of an access railroad and highway, construction bridges, and town sites for personnel engaged in building the dams. Detailed planning for the other three main-river dams and other units in the basin-wide development is proceeding as funds permit.

Construction is also under way on the Kanopolis Dam on the Smoky Hill River in Kansas, a flood control structure initiated before the war. Initial work is proceeding on the Harlan County Reservoir on the Republican River in Nebraska and the Cherry Creek Dam near Denver, Colo. Construction of flood protection levees at Omaha, Nebr., Council Bluffs, Iowa, Kansas City, Mo., and other locations on the lower river for protection of agricultural lands is in progress. Concurrently, the Bureau of Reclamation is active and construction is under way on Enders Dam on the Republican River in Nebraska and on work at other locations.

Garrison Dam, the largest unit in the basin-wide development, will impound the largest volume of water in a reservoir approximately 200 miles long. When completed, the dam will be 210 ft high, will have a crest length of over 2 miles and a base width exceeding $\frac{1}{2}$ mile. Pertinent details of the Garrison Project were given in the article, "Garrison Dam Preconstruction Contracts Inaugurate 75,000,000-Cu Yd Embankment Project," in CIVIL ENGINEERING for May 1947, page 18.

The second main-river dam on which construction has been initiated is Fort Randall. Its construction features generally are similar to those of the Garrison Dam but on a smaller scale. The dam, constructed also of rolled earth fill, will have a maximum height of 160 ft above the river channel and will impound 6,200,000 acre-ft in a reservoir 150 miles long. The embankment when completed will contain 30,000,000 cu yd and will have a crest length of almost 2 miles.

The spillway outlet works and the powerhouse will require 1,200,000 cu yd of concrete. Excavations will aggregate 60,000,000 cu yd. Power facilities will include at least two 40,000-kw units initially, with provisions for increasing the installation to eight when needed. Fort Randall Dam, being the lowermost of the large units, is contemplated primarily for flood control, navigation, domestic water supply, and power development. Construction of an access railroad and highway and a town site, designated officially as Pickstown, S.Dak., is under way.

Progress on Other Dams

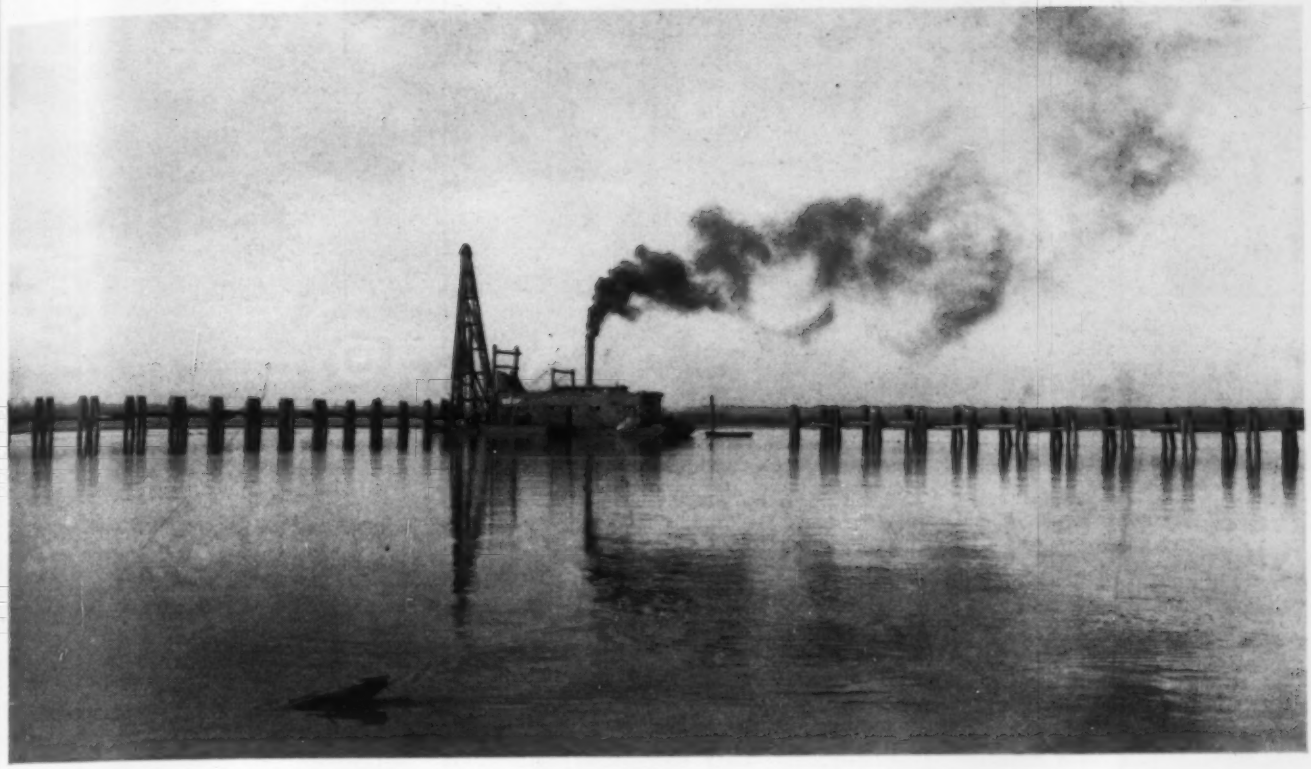
Preparation of engineering plans for the other three main-river dams, Oahe, Big Bend, and Gavins Point, is advancing as funds permit. Oahe Dam, which is similar to Garrison in reservoir storage and construction quantities, will be about 225 ft high, and will require 80,000,000 cu yd of earth fill and 2,000,000 cu yd of concrete. Its functions are flood control, irrigation storage, power production, navigation, and domestic supply.

Big Bend and Gavins Point Dams are low structures of concrete and rolled earth fill. Gavins Point is contemplated primarily for reregulation of flow from the larger reservoirs. Big Bend Dam, with an average net head of about 55 ft, is designed primarily for power development.

Technical problems of interest to engineers center mostly around foundation requirements. The Missouri River valley through the Dakotas is devoid of bedrock of the "hard rock" family. The valley is cut into a series of poorly indurated sediments of the Pleistocene, Tertiary, and Upper Cretaceous Ages.

TABLE I. DATA ON FIVE LARGEST RESERVOIRS

RESERVOIR	LOCATION	POOL ELEVATION Ft above mean sea level	RESERVOIR AREA Acres	RESERVOIR CAPACITY Acre-ft
Garrison	75 mi. above Bismarck, N.Dak.	1,850	390,000	23,000,000
Oahe	6 mi. above Pierre, S.Dak.	1,620	298,000	21,800,000
Big Bend	25 mi. above Chamberlain, S.Dak.	1,410	23,800	450,000
Fort Randall	75 mi. above Yankton, S.Dak.	1,375	107,000	6,200,000
Gavins Point	10 mi. above Yankton, S.Dak.	1,195	17,000	170,000



NAVIGABLE DEPTHS FOR CHANNEL from mouth of Missouri River to Sioux City, Iowa, are provided by means of bank revetments and dikes. Here, wood pile dikes are constructed to train river for navigation and prevent bank erosion.

One of the formations encountered is the Carlisle shale, a structurally low type of siltstone, which will form the foundation of Gavins Point Dam. Overlying the Carlisle shale is the Niobrara chalk, an uncrystallized rock resembling limestone chemically. This chalk, considered the best formation found at any of the dam sites, will form the foundation of concrete structures at Fort Randall Dam. Above the Niobrara chalk is Pierre shale, a dark-colored, loosely compacted shale which contains bentonite seams. Pierre shale will form the foundation at both Oahe and Big Bend Dams.

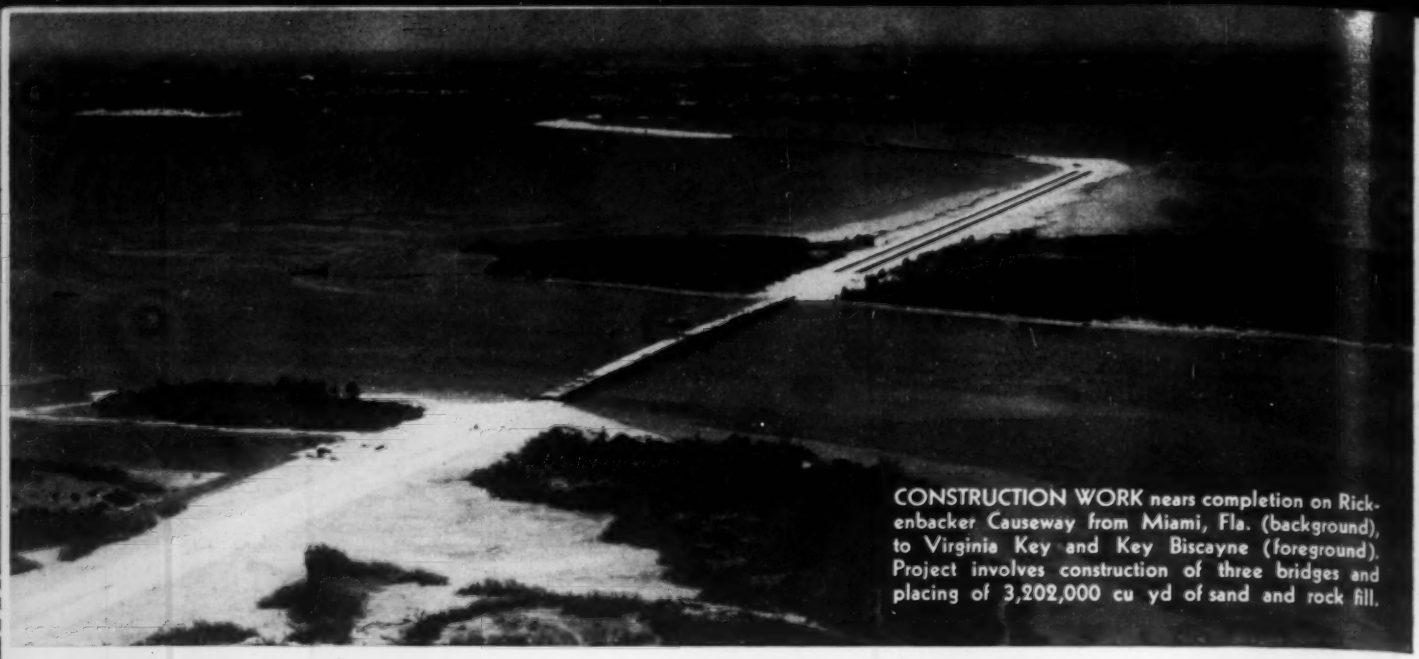
The river valley itself, in the reach below the mouth of Yellowstone River, has been eroded about 150 ft below its present level. The old channel has been filled by depositions of clay, silt, and sand, causing the present channel and low-level flood plain to be alluvial in character. The depth of the deposition makes its removal infeasible, and portions of the dams will be founded on this deposition. Supplemental means to assure stability and prevent underseepage will be required. Foundation explorations, soil tests, and model studies are being conducted to establish design criteria.

Special Earthmoving Equipment Needed

The large quantities of earth that will be required in construction will involve construction and earthmoving equipment of special design. Construction schedules contemplate placement of 2,000,000 cu yd of earth fill and 100,000 cu yd of concrete a month. Climatic conditions are such that operations can be conducted only 8 or 9 months of the year. Building these huge dams is a challenge to the engineering profession and it is anticipated that new methods and equipment will be developed as was the case in the building of Fort Peck Dam.

This article is based on a paper presented before the Waterways Division at the ASCE Annual Convention in Duluth, Minn.

FOUNDATIONS FOR BUILDINGS under construction at Pickstown, S. Dak., are dug by jeep with power takeoff excavating unit. Contractor is Busboom & Rauh, Salina, Kans.



CONSTRUCTION WORK nears completion on Rickenbacker Causeway from Miami, Fla. (background), to Virginia Key and Key Biscayne (foreground). Project involves construction of three bridges and placing of 3,202,000 cu yd of sand and rock fill.

Rickenbacker Causeway—$6,000,000 Project Joins Miami with Nearby Keys

ALTHOUGH ACTUAL CONSTRUCTION work on the Rickenbacker Causeway from Miami to Biscayne Key began as early as 1941, the 3.9-mile structure is just now nearing completion. Work stoppages and slowdowns caused by the war, materials shortages and, to some extent, labor troubles, combined to delay the opening date. The new causeway opens to vehicular traffic an area slightly greater than that of the highly developed portion of Miami Beach south of the N.E. 79th Street Causeway, providing possibilities for development of recreational areas and for public and private enterprise. This paper was presented before the ASCE Construction Division at the Fall Meeting of the Society.

EARLE M. RADER

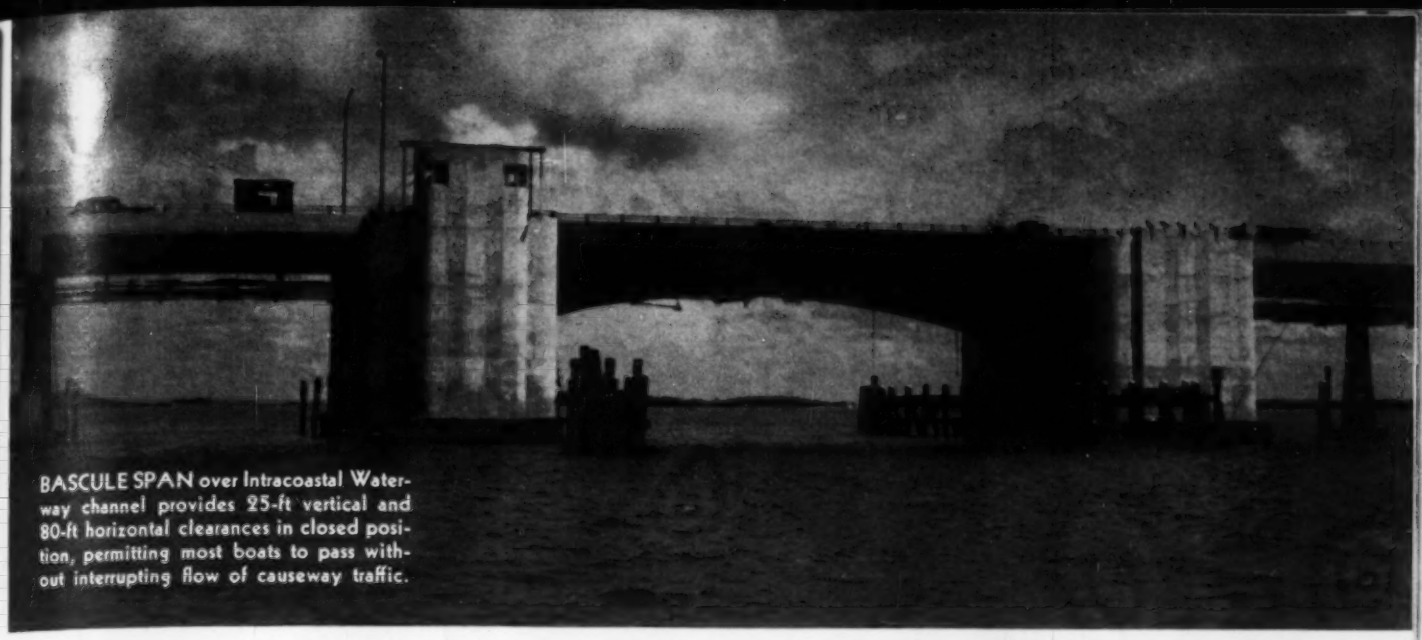
County Engineer, Dade County, Fla.

RICKENBACKER CAUSEWAY, constructed by the Board of County Commissioners of Dade County, Fla., is about to be opened to give vehicular access to Key Biscayne and Virginia Key, from the City of Miami, Fla. It leaves the mainland at S.E. 26th Road and crosses Biscayne Bay to Virginia Key, and from thence to Key Biscayne (Fig. 1). It is a double-drive, four-lane modern highway with an up-to-date white-way lighting system. The primary reason for the causeway is to provide access to beautiful Crandon Park (on Biscayne Key) with its 2 miles of ocean beach and its luxurious tropical trees and shrubbery. The causeway, however, will also serve the privately owned portion of Key Biscayne, the City of Miami-owned portion of Virginia Key, and will undoubtedly eventually serve Fisher Island, a short distance north of Virginia Key. (Fig. 2.)

The causeway project, including bridges, is 3.9 miles long starting at the Florida East Coast Railway at 26th Road and running to Biscayne Key. A motorist starting at the westerly shore of Biscayne Bay and driving easterly will travel first over what is known as the west bridge which is 0.11 mile long. After traversing a filled section 0.70 mile long he will cross the main bay bridge 0.71 mile long and near the center of this structure he will cross a bascule-type lift bridge over the Intracoastal Waterway channel. Directly east of the bay bridge the motorist crosses another fill 1.55 miles long over the southwesterly end of Virginia Key to Bear Cut and from that point he travels across the Bear Cut Bridge for 0.38 mile to Crandon Park on Key Biscayne.

Actual construction of Rickenbacker Causeway started in December 1941 with the dredging work performed by the Arundel Corp. Soon thereafter the Reed Construction Corp. commenced its contract for the bascule lift span, and the E. H. Latham Co. got under way with its contract for the fixed-beam bridges.

CAUSEWAY'S MODERN four-lane double-drive highway makes Crandon Park easily accessible recreation center. White areas in foreground are newly constructed parking facilities in Crandon Park. Virginia Key and Miami, Fla., are seen in background.



BASCULE SPAN over Intracoastal Waterway channel provides 25-ft vertical and 80-ft horizontal clearances in closed position, permitting most boats to pass without interrupting flow of causeway traffic.

Most of the fill in the causeway was completed, the concrete work on the bascule piers practically finished, and a part of the piling driven for the fixed-beam bridges before war conditions reached the point where the work had to be stopped. However, bulkheading work had to be started at that time and carried through to completion because of an order from the Chief of Engineers requiring that the bulkheads be completed to keep the fill from washing into the channel, which would have been a detriment to the war effort. So work on Rickenbacker Causeway never actually stopped during the war, although it did reach low ebb several times and change a number of times from one activity to another.

Monotube Casings Driven

During the winter of 1942–1943, when the pile driving work was getting under way, considerable difficulty was experienced in driving the hollow metal Monotube casings that were later filled with reinforced concrete to form the foundations for the fixed bridges. The rock in the subsoil was found to be considerably harder than anticipated and a number of Monotube casings were spoiled in attempting to drive them. The solution, however, proved to be the use of a combination large-size metal punch and hydraulic jet. By punching and jetting, along with the driving, the piles were placed quite easily to obtain the correct loading values.

Each pier of the fixed-beam bridges is supported on five piling, four of which lean toward a central vertical piling. In early pile-driving operations the batter piles were driven by moving the equipment and changing its anchors for each pile, thereby consuming more time than was anticipated. However, after considerable study a

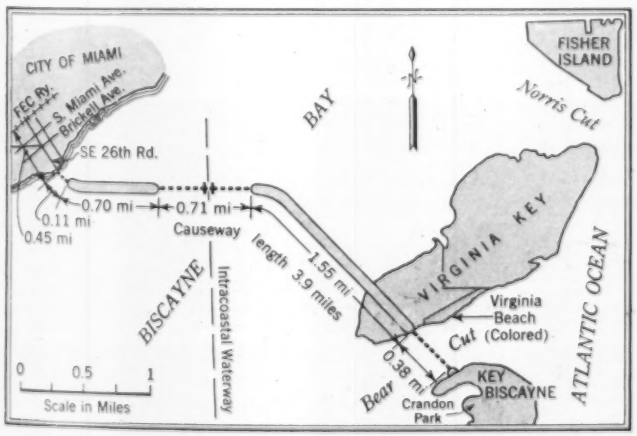


FIG. 1. CAUSEWAY from Miami, Fla., to Key Biscayne—distance of 3.9 miles—crosses the Intracoastal Waterway and provides vehicular access to Crandon Park. Causeway also serves privately owned part of Key Biscayne, Virginia Key and eventually is destined to serve Fisher Island.

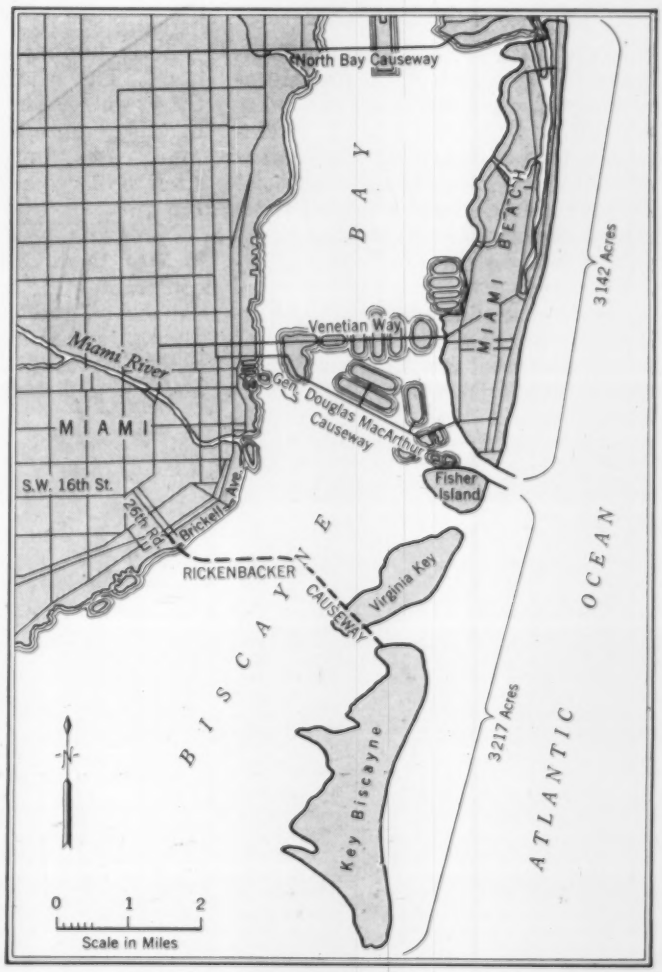
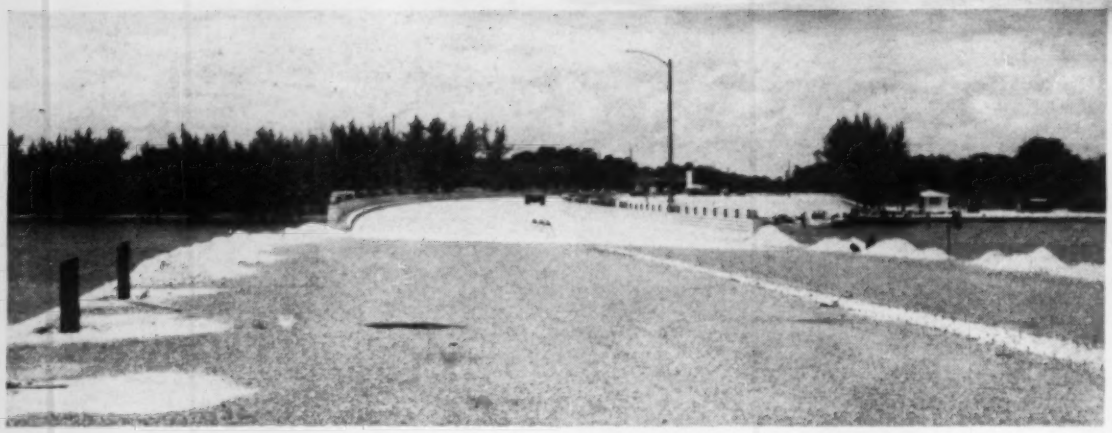


FIG. 2. AREA TO BE SERVED by Rickenbacker Causeway is 3,217 acres as compared with 3,142 acres in the highly developed resort area of Miami Beach south of N.E. 79th Street Causeway. Plans are being made for University of Miami marine laboratory and a $2,000,000 aquarium on Virginia Key.



BRIDGE AT WEST END of causeway, 0.11 mile long, connects mainland with first fill section, 0.70 mile long. Proceeding eastward on causeway motorist crosses 0.71 mile of main bay bridge, another 1.55 miles of fill section and Bear Cut Bridge 0.38 mile long. Total length of causeway, including 0.45-mile section in Miami, is 3.9 miles.

plan was devised whereby the leads that held the pile during driving could be tilted to the left and to the right, as well as forward and backward. These alterations made it possible to drive all five piling for each foundation without changing the anchors on the floating equipment, and materially speeded up the work.

Shortage of Critical Materials

In the fall of 1945 work on the fixed-beam bridges portion of the causeway again got under way, but many difficulties were experienced. Reinforcing steel was one of the most critical items, and in purchasing such steel Dade County changed contracts three times before satisfactory arrangements were made for the delivery of reinforcing steel.

On the last contract, with a Birmingham organization, supplies of reinforcing steel ran so low at times that one day's delay in delivery would have necessitated shutting down the reinforced concrete work. The writer recalls one occasion when a car was traced from Birmingham to Miami by long-distance telephone, through the various railroad dispatchers along the way. When the car finally arrived at the last minute, several of us felt as though we had physically pushed the car all the way from Birmingham.

Form lumber was another critical item. The whole southeast part of the country was scoured to scrape together an adequate supply. In some cases lumber was bought in sizes too large and then was recut at the mill.

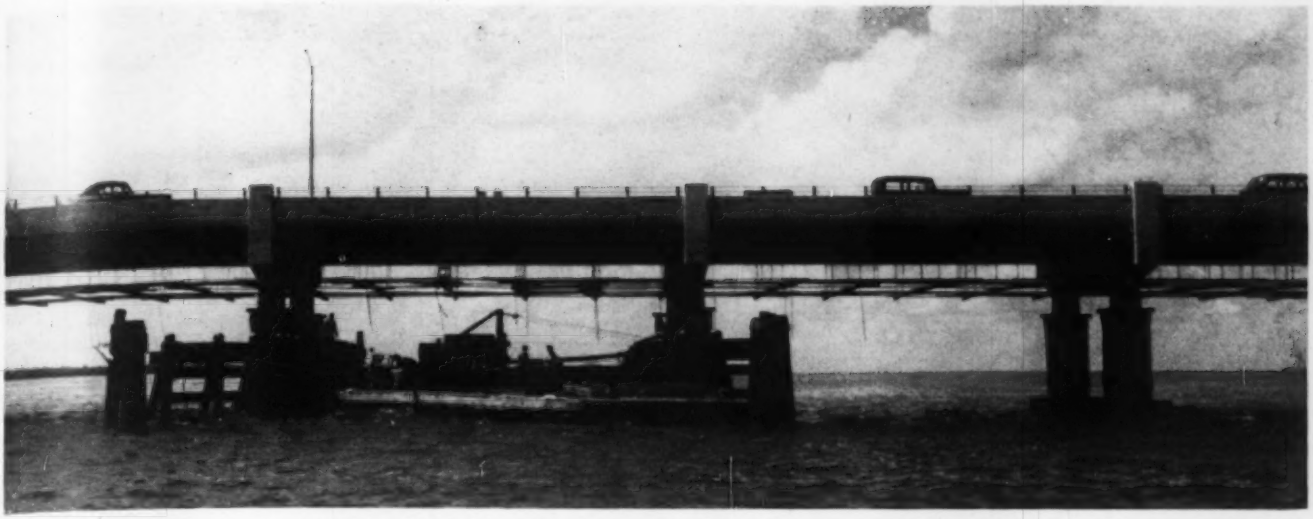
Nails may be small articles but the lack of them practically shut down construction of the $6,000,000 Rickenbacker Causeway. Men were sent about the country to pick up what nails they could buy—a pound here and a pound there. Any type of nail that could be bought had to be used, many of them being the old-style square-cut nails. Many calls were received from various generous parties who offered to sell black market nails at prices ranging up to $100 per keg.

Procurement of electrical equipment has been most troublesome. Numerous changes in the original plans had to be made to use whatever equipment could be obtained in time to open the causeway this fall. Electrical manufacturers, however, have been most accommodating and if it had not been for their cooperation the causeway would not open in 1947.

Labor Difficulties Experienced

This project has not been without its labor troubles. First there was a shortage of men, then a shortage of the right kind of skilled labor. On one occasion there was a strike of common labor that fortunately had no serious consequence. In fact, a

BEAR CUT BRIDGE from Virginia Key to Crandon Park on Key Biscayne does not include draw span because government requires all boats from foreign ports to enter Miami Harbor through Government Cut for check. Shallow Bear Cut Channel takes small craft only.



DRIVING OF MONOTUBE CASINGS into hard rock for piers of fixed beam bridge spans, requires use of large-size punch and hydraulic jet. Piers consist of four batter piles leaning toward vertical center pile. Leads are tilted to permit driving of all five piles without changing position of floating equipment.

call to the employment agency brought on the following day more common laborers than could be used. On another occasion certain skilled laborers conspired to cut down their production by more than half the work they had been doing. The matter was speedily handled by discharging the ring leaders of the conspiracy.

The question has been asked repeatedly why a draw span was not used in the Bear Cut bridge. The answer is that in lengthy discussions of the matter—before contracts for the causeway were let—government officials objected to a draw span because they wanted all boats to enter Miami Harbor through the Government cut where they could be checked for quarantine, immigration, customs, etc. Another reason for no draw span is the fact that because of shallow water only small boats can go through Bear Cut Channel.

Bascule Span Over Navigation Channel

At the bascule-span crossing of the Intracoastal Waterway channel there is a vertical clearance of 25 ft and a horizontal clearance of 80 ft when the bridge is in the closed position. These clearances will permit the majority of boats to traverse the channel without having to open the bridge and interrupt the flow of vehicular traffic on the causeway. However the most modern and up-to-date machinery and equipment have been installed at the lift bridge so that it can be operated safely with a minimum loss of time.

Dade County owns 170 acres at the southwest end of Virginia Key where the colored Virginia Beach is located and where plans are being made for a $2,000,000 aquarium and a University of Miami marine laboratory. By bulkheading and straightening the shoreline along this property an additional 10 acres of land will be created. The County also owns 906 acres in Crandon Park and this area will be increased by about 200 acres when the bay side of the property is bulkheaded and the shoreline straightened. On Key Biscayne, 1,198 acres is privately owned while on Virginia Key, in addition to the County-owned property, 525 acres is owned by the City of Miami.

It is logical to assume that since Norris Cut is not a navigable waterway for boats of any size, it is only a matter of time until a bridge will be built to serve Fisher Island, which has an area of 208 acres. The three Islands—Key Biscayne, Virginia Key and Fisher Island—total 3,217 acres, an area slightly greater than that portion of Miami Beach which extends from the Government Cut north to the N.E. 79th Street Causeway, covering an area of 3,142 acres. This comparison gives some idea of the area that will be opened to development by completion of the Rickenbacker Causeway.

Large Materials Quantities

Following are some of the quantities used in the Rickenbacker Causeway:

1. Fill—3,202,000 cu yd.
2. Steel work for bridges and reinforcing:
   Structural—6,974,000 lb.
   Reinforcing—4,280,000 lb.
3. Cement—48,510 bbl.
4. Man-hours of actual construction—1,074,900 hr.
5. Fresh-water mains—18,000 lin ft, 12-in. dia.
6. Electric light standards and wire—110 standards, 150,000 lin ft of wire.
7. Pavement—111,000 sq yd.

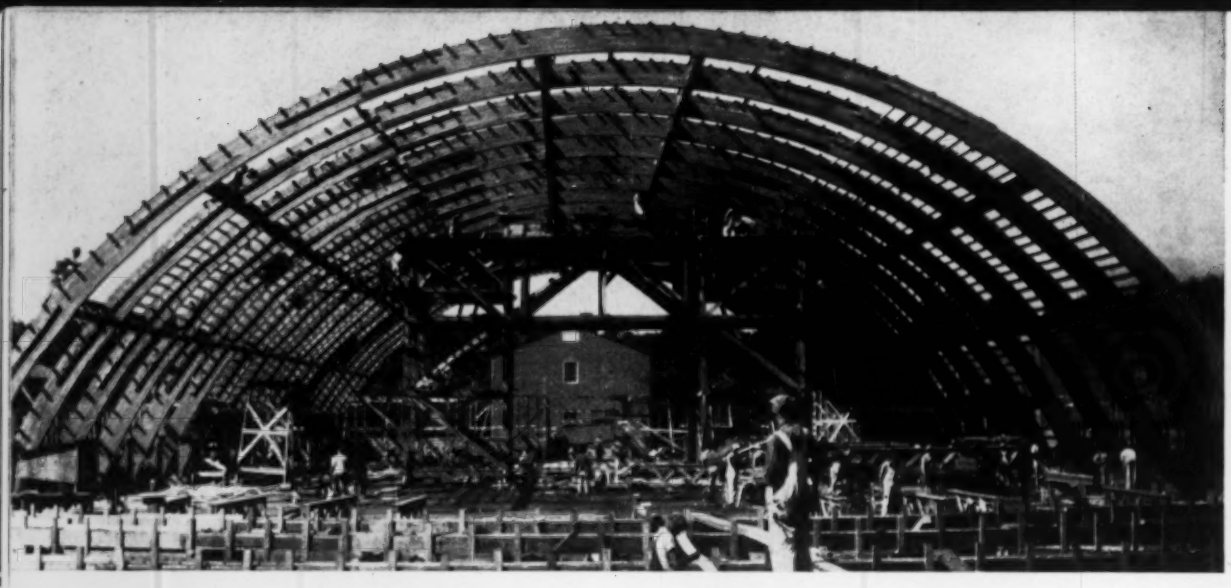
The original estimated cost of the project was $4,000,000 and bonds were sold on a self-liquidating basis for that amount. However, because of increased material and labor costs caused by war conditions, an additional $2,000,000 worth of bonds had to be sold in order to complete the job, making the total cost of the causeway $6,000,000. The financing of the project is entirely on a self-liquidating basis and the bond purchasers will have to look entirely to the revenue produced by the causeway for repayment of funds advanced by them. Taxpayers of Dade County are not responsible in any manner for the repayment of such funds.

The Board of County Commissioners has fixed the round-trip toll schedule to be charged on Rickenbacker Causeway as follows:

1. Automobiles and taxicabs, without limit to number of occupants	$0.50
2. Trucks, up to and including 1½ tons, net load	0.75
3. Trucks, over 1½ tons, net load	1.00
4. Motorcycles	0.35
5. Pedestrians, bicycles	0.25
6. Buses	1.00
7. Special vehicles—approximately 25 cents per ton, gross weight	

For frequent users of the causeway the board has authorized the sale of commutation tickets—a book of 24 tickets for $6 to be used within 60 days. This privilege will reduce the round trip cost to 25 cents.

After this writing, the Rickenbacker Causeway is about to be opened to traffic.



WOOD RESEARCH, intensified during last war, has resulted in adoption of 20 percent higher working stresses in postwar construction. Three-piece, 120-ft-span, glued laminated lumber arches (left) are erected for one of mammoth drill halls and auditoriums used in Navy training program. (Photo courtesy U. S. Navy)

War Experience Accelerates

Standardization of Timber Design and Construction Procedures

TIMBER DESIGN AND CONSTRUCTION have experienced considerable technical advancement in recent years. The war intensified wood research and accelerated new developments, many of which were well under way before the war. Through the exigencies of war, wood construction was flagrantly abused but its performance under these adverse conditions added greatly to our fund of knowledge and developed increased confidence in this type of construction. Some of the more important developments include: Stress grading of lumber, improved lumber inspection, increased knowledge of the properties of wood itself, more accurate evaluation of the load-carrying capacities of lumber fastenings, development of connector and glued laminated lumber constructions, and standardization of engineering design procedures in lumber. These factors together with four years of nation-wide experience with structures designed under higher allowable stresses, resulting in adoption of postwar lumber working stresses which are 20 percent higher than those commonly used prior to the war, are described herein. The forest products industry and future wood supply are also discussed. This article is based on a paper presented before the Structural Division at the ASCE Fall Meeting.

FRANK J. HANRAHAN, M. ASCE

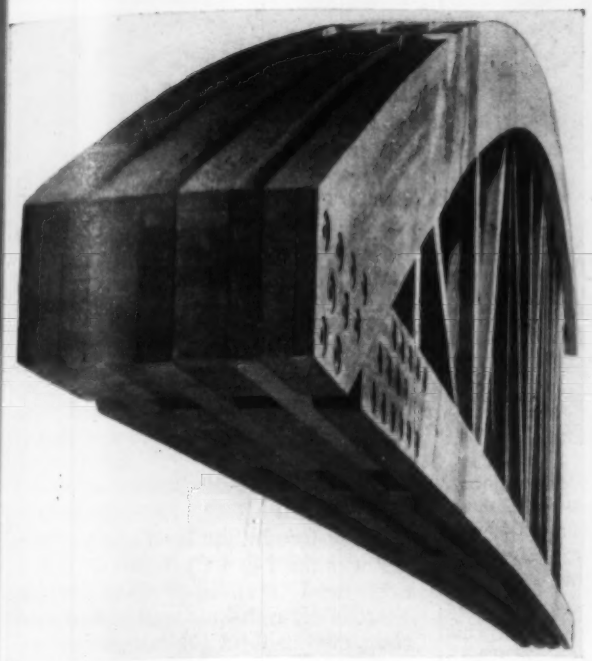
Chief Engineer, National Lumber Manufacturers Association, Washington, D.C.

IT IS NOT COMMONLY realized that there are more reliable factual and fundamental research data on wood than on any other structural material. The entire wood field—including silviculture, harvesting, wood technology, wood chemistry, physical properties of wood, wood treatments, and wood utilization—has been investigated extensively. However, by this statement the writer does not intend to imply that all technical questions have been fully answered.

In addition to centuries of full-scale tests of millions of wooden structures in service throughout the world, there are enormous quantities of laboratory research data. One of eight divisions of one laboratory, the Timber Mechanics Section of the U.S. Forest Products Laboratory, Madison, Wis., has conducted more than 3 million scientifically controlled primary and auxiliary tests related to strength properties alone. These tests are planned to bring to light additional technical information on wood and its fastenings and are not merely routine tests used as manufacturing controls.

Most of the technical findings of research organizations working on wood are available in various publications. The March 1944 issue of the ASCE PROCEEDINGS contains a bibliography of some publications of interest to

ONE-PIECE, 46-FT-SPAN, glued laminated lumber arches—264 of which were installed in Brunswick Drug Co. building, Vernon, Calif.—have balanced thrust. (Photo courtesy Summerbell Roof Structures, Los Angeles, Calif.)



CLOSE-UP OF FOUR-LEAF, 140-ft Beech Aircraft Co. bowstring truss shows ends of glued laminated members and exterior connector grooves at heel joint. (Photo courtesy Timber Structures, Inc., Portland, Ore.)

WOOD ROOF FRAMING of Our Lady of Good Council Church, Newark, N.J., preferred for its beauty and ecclesiastical tradition, is double hammered-beam type with glued members. (Photo courtesy Roof Structures, Inc., New York, N. Y.)

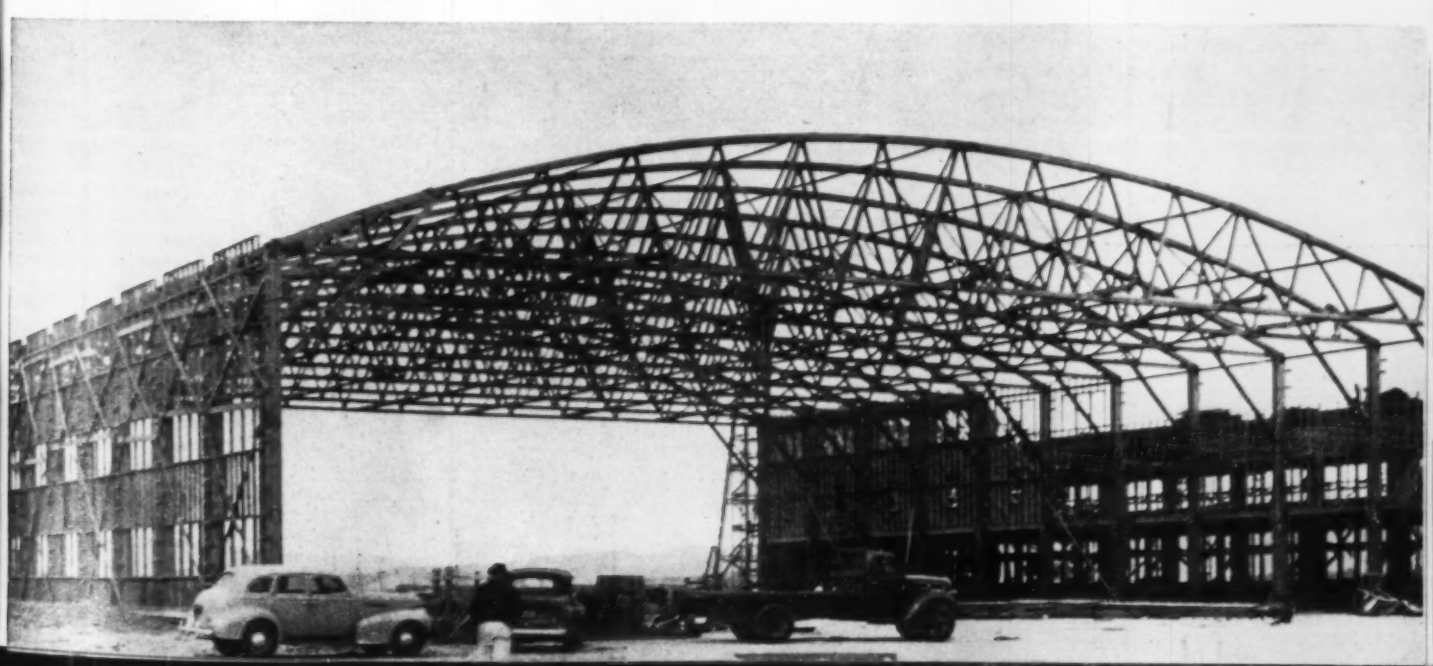
civil engineers. Another useful bibliography appeared in E. George Stern's article, "Modern European Practice Promotes Economic Use of Timber Structures," CIVIL ENGINEERING for April 1947, pages 35–39.

It is on scientific data from such sources and on practical experience that modern stress grades of lumber, lumber inspection and design recommendations for wood and its fastenings are founded. Yet, paradoxically, the war brought out the fact that most structural engineers of this country are not as well informed on wood as on other structural materials. An examination of war structures will reveal that no structural material has been so abused as wood. Possibly the explanation lies partly in the fact that many engineers have not been given adequate training in wood design and construction in the technical schools and have not corrected this deficiency subsequently, and partly in the fact that wood is known to be a material which can take abuse.

Teaching Timber Engineering

Because of the non-homogeneous properties of wood, proper design in timber calls for a better knowledge of engineering fundamentals than design in most other materials. Fortunately, progressive schools are now devoting more time to instruction and research on wood. Many schools and teachers feel that their structural engineering graduates should be equipped to render their employers and clients the maximum of service by being able to design efficiently, or at least intelligently, in whatever material best and most economically fulfills the structural requirements. The economy of wood structures is indicated by a study of contract awards, made just before the war with prices at their normal competitive level, which showed the bids on timber construction running about 15 percent

DURING 1941, 1942 AND 1943, 75 billion board feet of lumber was used in this country for military and civilian construction. Army hangar pictured here contains 165-ft clear span trusses with glued laminated lumber chords, webs and columns joined with TECO connectors. (Photo courtesy Summerbell Roof Structures, Oakland, Calif.)



TWELVE BOWSTING TRUSSES of 201-ft 6-in. clear span, in Fisher Body Plant building, have glued laminated lumber top and bottom chords and 28-ft 8-in. glued laminated columns. Trusses are spaced 30 ft center-to-center and designed for 30-lb-per-sq-ft live and 20-lb-per-sq-ft dead load with TECO connectors. Members were fabricated in Portland, Ore., and erected in Cleveland, Ohio. (Photo courtesy Timber Structures, Inc., Portland, Ore.)

lower in the East and 45 percent lower in the Southwest and West than on alternates in other materials. Technical training is treated by Howard J. Hansen, Assoc. M. ASCE, in his paper, "Advancement in Timber Mechanics and Design Calls for Specially Trained Engineers," in this issue.

Findings from War Structures

During the war, government agencies concerned with the use of materials took what we would consider in normal times very drastic action in lowering safety factors to accomplish national objectives. Although probably an extreme case, a large number of the war buildings in wood were designed and built as follows:

Designs were made on the basis of a roof load of 15 lb per sq ft. These buildings were built in the same areas where building codes require that designs be based on roof loads of 20, 30 or more pounds per square foot, i.e., they were constructed throughout the country. Designs were based on the assumption that a 1,200-lb-stress grade of lumber would be used. However, the design stresses used for this grade were increased from 1,200 to 1,800 lb per sq in.

Lumber was purchased by auction and certain quantities had to be bought to satisfy requirements. All of the 1,200-lb-stress grade material offered was purchased, but this was but a fraction of the requirements, so lumber of other grades was purchased until the desired quantity was obtained. This included a considerable quantity of No. 1, No. 2 and even No. 3 grades of non-structural timber, i.e., yard lumber not graded for strength.

IN AN AVERAGE YEAR, the United States accounts for 43 percent of the world's forest production. The United States makes over 50 percent of the world's paper and for more than a century has produced from 65 to 80 percent of the world's annual production of naval stores. An attempted census of the uses of wood once reached a count of 4,500 without approaching a full or exhaustive classification. Even in large cities remote from the forests, it would be difficult if not impossible for any one to disassociate himself, even momentarily, from wood in some form or other.

The haste with which the war job had to be done, together with its size, made necessary the use of much personnel with limited or no experience with design, fabrication and erection of wood structures. There was little time for refinement and checking. Errors were made. Such things are inherent in an emergency undertaking, but the important thing is that the job was done and that it was done on time.

One government source estimated that, during 1941, 1942, and 1943, seventy-five billion board feet of lumber was used in this country for military and civilian building alone. That is enough lumber to build more than two million GI homes per year on top of all the other war uses of wood. At the same time wood was being demanded in great quantities for thousands of items of wartime supplies and equipment, overseas construction, and for boxing and crating. Many of the buildings had clear roof spans well in excess of 100 ft.

In addition to working closely with the various war agencies, the lumber industry made a serious attempt to have at least one of its engineers investigate every timber structure in which any serious trouble was reported. Realizing that most of its wartime buildings were far below peacetime standards, the Army issued instructions that all its timber buildings on this continent be inspected and reported on. Likewise, the Navy and other agencies made arrangements for checking and servicing their war structures. From these and similar sources much technical information was obtained. No serious trouble has been found in any timber structure either in peacetime or in wartime where proper procedures were fol-

STATE HIGHWAY BRIDGE on Allagash River is of wood construction with metal gusset plates and TECO shear plate connectors. Center span truss 160 ft long, and two side span trusses 120 ft long were fabricated in New Jersey, then pressure treated and shipped to near St. Francis, Me., where they were assembled and erected. (Photo courtesy Weyerhaeuser Timber Co., Newark, N.J.)

lowed. Some findings from such investigations are of special interest.

Many Mistakes Made

In one large industrial building, parallel-chord Warren trusses of considerable span were used in the roof system. Inspection revealed that all the trusses had been installed upside down, that is, under load, the stresses in the truss members were reversed. The tension members acted in compression as columns and vice versa. As a further complication, monorails designed to be supported at a truss panel point a certain distance from the walls were suspended midway between the panel points of the Warren trusses.

At one site a considerable number of fairly large buildings were designed as a split-ring timber connector job. As is well known, such a connector will carry about four times the load that the bolt used with the connector will carry alone. Excessive deflection of the roof trusses was reported. Inspection revealed that for some unknown reason every bolt had been installed, but not a single connector had been put in.

Omission of connectors might be considered an argument against this type of construction, but it is no more valid than the argument that concrete should not be used because there is a possibility that cement and reinforcement might be left out. It is a matter of adequate supervision, and it is easy to determine whether connectors have been omitted by inserting a thin metal probe.

Trouble had been reported with an important joint of a 100-ft timber roof truss. Examination of both the joint itself and the detail design drawings showed that only two of the three load-carrying members entering the joint were fastened to the gusset plates. Further examination revealed that one of the two members was jointed to the gusset plate with only one pair of 4-in. split rings having a design load capacity of about 10,000 lb, whereas the load to be transferred was about 100,000 lb. Apparently the decimal point was misplaced.

Undesirable Features Found

Many other comparable cases could be cited, but possibly it would be more desirable to summarize some of the more common or important undesirable features found in wartime construction.

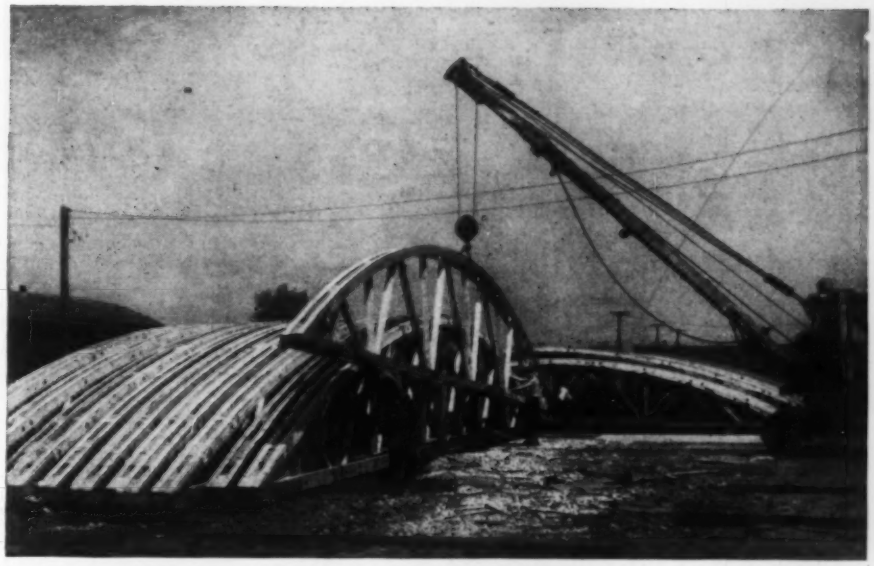
In design, among the more common faults were: Poor joint design; failure to provide adequate truss camber, particularly when using unseasoned lumber which requires more camber than dry lumber; failure to provide hangar or other door details which left operation of the door unaffected by truss deflections; use of trusses with a height-span ratio which was too low; improper design of columns or compression members such as assuming that a built-up nailed or bolted member acts as a solid member, or designing spaced columns improperly; and application of principles or procedures used for metal design without adequate regard to the properties of wood—that is, failure to recognize that wood is a non-homogeneous material, i.e., that the strength in all directions is not the same.

With respect to the lumber, undesirable features were the use of nonstructural and ungraded lumber where structural lumber was indicated and the use of an improper structural grade.

With respect to fabrication and erection, among the more common faults were misfabrication and sloppy workmanship such as boring bolt holes and connector grooves at the wrong location and then reboring nearby to correct the error; using wider or deeper connector grooves than specified; inaccurate fabrication followed by horsing around and mauling the members into place during assembly; omission of fastenings; rough handling such as picking up large trusses at a single point or dropping the trusses during erection; improper storage of lumber awaiting fabrication or erection; resawing of lumber without regrading; and omission of specified truss bracing and splice plates.

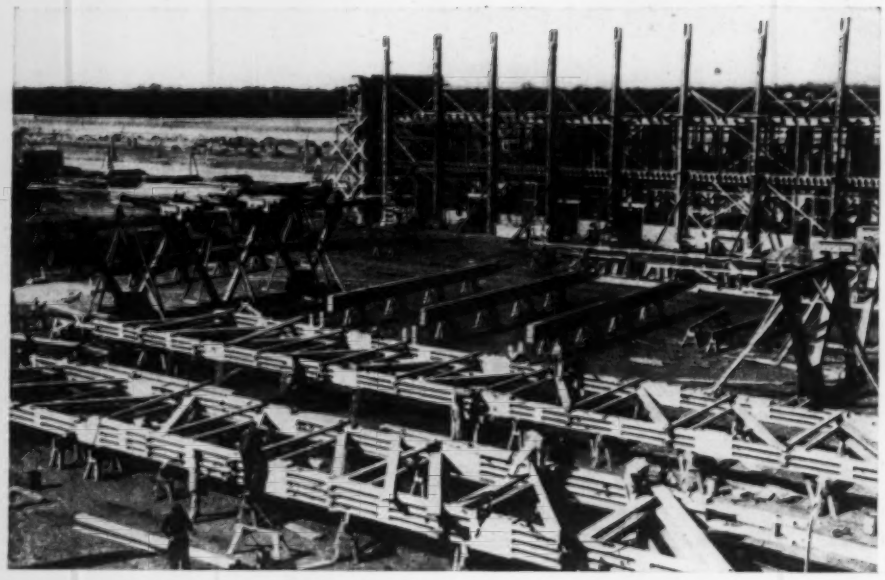
With respect to maintenance, the item most neglected was the drawing up of bolts as the wood seasoned to the approximate moisture content of service. This neglect sometimes resulted in repairs such as replacement or reinforcement of members. There were instances where the reinforcement and repairs installed were not effective and efficient. There were cases of excessive wind and snow loads and of excessive water loads on roofs without proper drainage.

In spite of the fact that many thousands of large wartime timber buildings were constructed under these unfavorable circumstances, very few instances have been reported where a roof truss actually came down. In a number of cases inadequate members were placed or reinforced and bad



FACTORY FABRICATED TRUSSES are shipped to Middle West where 380 are required for constructing 19 hemp mills. Trusses, shown here assembled, can also be shipped in knockdown form. (Photo courtesy McKeown Bros., Chicago, Ill.)

OUR FOREST RESOURCES are grossly underestimated by most people. The forest area of the United States equals approximately 1½ times that in food and textile crops combined, or nearly 5 acres per capita. With respect to future supply, the Chief Forester of the United States has stated: "Wood, in contrast to so many other engineering materials, is a crop and the supply can be renewed indefinitely," and "The only acceptable philosophy for balancing the drain with the growth is to grow more timber—not to use less. If reasonably good forest practice is applied generally throughout the country, we may expect to build up forest growing stock in the course of the next century to yield a cut of 21 billion cu ft annually. This is substantially in excess of the current rate of utilization and should be ample for all foreseeable needs."



NAVY HANGAR constructed during war on Jersey coast has two bents, each spanned with 120-ft wood trusses of typical TECO connector construction. (Photo courtesy Weyerhaeuser Timber Co., Newark, N.J.)

construction details remedied. In many cases, stitch bolts or clamps were installed in or on checked or split members, but frequently those that were installed were not needed.

Although unquestionably there were cases where trusses might have come down if they had not been shored and reinforced or repaired, information available to the Office of the Chief of Engineers of the Army indicates that there were only four wood buildings in which a truss or a larger unit of construction actually failed. Further, the Army records do not show any person killed or seriously injured from structural failures. No figures are available in the Office of the Chief of Engineers which show the amount of property, if any, that was destroyed by truss failures of wood structures. For Army buildings having a floor area of approximately one billion square feet and equivalent to a wood building 70 ft wide reaching from New York to San Francisco, most of which was built under war conditions with its attendant abuses, this is a most remarkable record of service by wood construction.

The practically unanimous reactions of engineers, without and within the industry, who inspected the wartime timber structures were: (1) Amazement that many more failures did not take place in wartime structures in view of their abuse; and (2) a firm conviction that the design stresses in use prior to the war for stress-grade lumber were far too conservative, and therefore uneconomical, for timber buildings properly designed and constructed.

As a matter of fact, in August 1943, the War Production Board issued a mandatory directive requiring an increase of 20 percent in working stresses for stress-grade lumber and in design loads for fastenings for timber buildings. Further, specific provision was made for the use of higher working stresses by the Army, Navy, and Maritime Commission to meet the objection that this increase of 20 percent was not large enough.

Pending a more exhaustive study, the U.S. Forest Products Laboratory subsequently recommended continuation of the use of the increased stresses of the WPB directive for postwar building construction.

Postwar Design Specifications

In December 1944, the Board of Directors of the National Lumber Manufacturers Association approved as recommendations for postwar application the "National Design Specification for Stress-Grade Lumber and Its Fastenings," which contains the same recommended stresses as were mandatory under WPB Directive 29 for buildings. This is a complete design specification containing working stresses for lumber, design procedures, safe loads for fastenings and laminated lumber and recommended construction practices.

This specification was developed over a period of three years of study and consultation by the Technical Advisory Committee of the National Lumber Manufacturers Association in cooperation with various government agencies concerned with structures, timber fabricators, organizations publishing grade rules, and many engineers of long and varied experience in timber design and construction.

In formulating the provisions of the specification, the most reliable data available from both laboratory tests and experience with structures in service were carefully considered for the purpose of providing a technically sound national standard. Also, consideration was given to standard commercial practices, the use of which provides greater economy in construction.

This specification is based on the assumption of competent engineering design, accurate fabrication and adequate supervision. It also assumes that the preparation, installation, and joining of wood members, connectors, mechanical devices, and adhesives will conform throughout to good engineering practice and that properly grade-marked or certified stress-grade lumber will be used. This specification is recommended for general use by engineers, architects, and building code authorities as a reliable guide and a standard for the design of structures. Application of the design specification not only assures adequate structures, but makes wood construction even more economical than it was previously.

Developments in Timber Engineering

Although extensive wartime use of timber connectors and glued laminated lumber construction brought broader realization of their merits, the increased efficiencies and economies of these constructions were well established before the war. However, during the war additional developments of postwar significance took place.

Designs developed in the last few years show considerable saving in

THE FOREST PRODUCTS INDUSTRY is one of the nation's oldest and largest industries. Authentic records show that there were sawmills in Jamestown in 1608, and it is probable that there were earlier mills in the older settlements. The 1939 Census rates the industry fourth in number of employees and sixth in value of products. The capital investment in the forest industries of the United States before the war was approximately $10,000,000,000. The 22,000 forest products concerns reporting to the Bureau of the Census in 1939 employed approximately one million persons, and it has been estimated that more than two million persons are directly dependent on the forests and on forest products for their livelihood.

lumber, hardware, and fabrication that reflect a sizable decrease in cost without sacrificing load-carrying capacity and utility. At its laboratory in Washington, D.C., the Timber Engineering Co. has under way a series of tests on full-scale trusses which will point the way to further efficiencies and economies in the connector system of construction. Also, the company has developed connectors of even greater efficiency.

In the last few years there has been a great amount of research and development in the field of glued laminated lumber. Glues are available which are as strong as the wood itself, are not affected by water, and will stand any exposure that the wood itself will endure.

Standards for glued laminated lumber are being developed under the auspices of the Central Committee on Lumber Standards, sponsored by the U.S. Department of Commerce. This is the same agency through which were developed the eminently sucessful American Lumber Standards, which were promulgated by the U.S. Department of Commerce through the Simplified Practice Procedure of the National Bureau of Standards.

The development and application of standards covering lumber, glue, gluing, fabricating practices, design, and performance of finished products will assure the consumer that the proper type of laminated construction is selected for the use intended and that such selections will be properly manufactured. It is expected that when the standards are established, inspection services will be available to assure conformance with them, in much the same way that such services are now available to assure conformance with current lumber standards.

Timber engineers are not complacent about past developments and accomplishments. Before, during and subsequent to the war many additional technical data were acquired which have not been fully analyzed. An extensive analysis of all available data pertinent to engineering design in wood is under way. If such studies indicate that added refinements should be made, they will be incorporated in the National Design Specification for Stress-Grade Lumber and Its Fastenings and in lumber standards. Also the present design specification will be studied from the viewpoint of obtaining further simplification to provide greater ease in application by designers. It is only by taking cognizance of, evaluating, and using new data as they become available that maximum scientific progress is made.

Weed Eradication Demonstrated

RELIEF FROM AN AGE-OLD PEST may be realized by highway and public works departments by following eradication methods demonstrated in the new sound film, "Death to Weeds." The film, which covers the entire range of weed pests, represents a new approach to the task of educating the public to means of preventing weed growth, which costs billions of dollars per year—the loss in potential food production alone amounting to nearly 3 billion dollars.

Based on more than 10,000 miles of travel by Jam Handy Organization camera crews for The Dow Chemical Co., the film reveals many types of weeds infesting the cultivated areas of the nation. Among those that affect the work of engineers are poison ivy, sassafras, sumac and other woody plants, found along power-line, highway and railway rights-of-way; water hyacinth, growing in canals and drainage ditches; and dandelion and plantain, in grass.

Modern techniques for weed elimination are pictured, ranging from ploughing and cutting, considered temporary remedies, to spraying with chemical weed killers. Actual death of weed over 15-day period is shown in sequence of time-lapse photography in the new film.

Supplied in 16-mm size in natural colors, the film has a screen time of approximately 20 minutes. Groups desiring to borrow it without charge may secure copies by writing to Millard Hooker, Dow Chemical Co., Midland, Mich.

SPRAYING WITH MODERN WEED-KILLERS (right) kills weeds outright or brings them under control until they can be crowded out by useful plant life. Engineers can protect health and reduce maintenance costs by turning new chemical weapons against harmful plants. Sound film on subject uses new approach in presenting up-to-date information to supplement that furnished by U.S. Government, state and other agencies for many years.

SHOP-CONSTRUCTED spraying equipment mounted on truck is inexpensive and easy to operate in applying weed-killing chemicals along highway rights-of-way. Equipment—design of The Dow Chemical Co. technicians—is made from parts usually available in highway maintenance shops. Actual death of weed over 15-day period is shown in sequence of time-lapse photography in new film.

Clear, Precise Specifications and Contracts Invite Lower Bids

GEORGE B. HILLS, M. ASCE
Reynolds, Smith & Hills

and

CHARLES F. LOVAN, M. ASCE
Hillyer & Lovan, Contractors

Jacksonville, Florida

CONTINUED INCREASE in the cost of labor, both by apparent increases in wage scales and by hidden influence of decreased production, is a major factor contributing to increased construction costs. It appears both through increases in direct labor costs on the job and through increases in costs of materials for which labor costs represent a major factor. However, solution of the problems involving labor costs is not the subject of this discussion which is concerned with another important factor—the opportunities available to the engineer, the architect, and the construction contractor to reduce construction costs by their own actions and practices. Clear, precise specifications and contracts should be a means to that end. This paper was presented before the ASCE Construction Division at the Fall Meeting of the Society.

AN UPWARD SPIRAL of costs, including those in the construction field, is recognized as a phenomenon of our postwar period. It can easily continue to a point resulting in a widespread curtailment of construction and allied activities, to the serious detriment of our national economy and of the interests of the professions directly concerned with such activities. Such a curtailment is already widely evident.

Dollar totals of the volume of current construction activities are not encouraging when analyzed in the light of unit costs involved. The actual work volume shrinks greatly under such an analysis. It behooves all concerned, including the members of the engineering profession, to take all steps that intelligence indicates may contribute to steadying or reducing construction costs. The problems involved are sufficiently serious to justify the best thinking and efforts of all concerned.

An owner is not ordinarily familiar with technical considerations such as subsoil conditions, moduli of elasticity, and the differences between fireproof and fire-resistant construction. He has an objective which he wishes to accomplish, and he engages engineers or architects to prepare plans and specifications and to supervise construction of a sound project which will meet his needs and which can be accomplished at a price he can afford to pay. It becomes the responsibility of the engineer or architect to prepare plans and specifications for such a project, meeting the functional or esthetic requirements of the owner.

In the development of plans and specifications and in supervision of subsequent construction, the engineer or architect should bear in mind that the completed project is the end desired, and that the plans, specifications and supervision are means to that end and not the end themselves. Not infrequently there is a disposition on the part of the engineer or architect to lose sight of that distinction. Although in some instances, particularly public work, legal requirements establish considerable inflexibility in the interpretation and application of plans and specifications, basically adjustments which will be to the advantage of either the owner or the contractor should be made if the interests of the opposite party concerned will not be prejudiced thereby.

Character of Work Should Be Specified

Plans and specifications should be prepared in form to acquaint the contractor with all of the details and the character of construction which he

PLANS AND SPECIFICATIONS frequently place on contractor all risk or gamble resulting from unforeseen conditions which develop. In photograph, unrecorded utilities disclosed by construction excavation required relocation of proposed manhole and duct line.

LOWER BID IS POSSIBLE when contractor knows he will be paid for work clearly indicated by plans and specifications. Pictured here are utilities disclosed unexpectedly in excavating for installation of new electrical duct line necessitating relocation of duct line and vault.

will be called upon to perform, and for which he will be paid on a basis clearly set forth in the specifications and the contract, provided he does good work.

Plans and specifications are frequently, if not usually, prepared in such form as to place on the contractor all risk or gamble resulting from unforeseen conditions which develop with the progress of the work. That policy may result in a saving to the owner on a particular job, but it is the writers' opinion that bid prices in the industry as a whole will be reduced if the contractor knows that he will be paid the amount of his bid for work which the plans and specifications clearly indicate he will be called upon to perform, and that he will be additionally compensated for additional work which unanticipated conditions may require.

The importance of such plans and specifications may be illustrated by a recent experience in the construction of an electrical duct line for a municipally owned utility. "As built" drawings and records of existing subsurface construction were incomplete. The construction contract provided that the contractor would be paid a unit price per foot of duct constructed along a prescribed line. As his work progressed, underground obstructions such as existing gas and water lines were encountered, requiring changes in location of his line, of manholes and of other details. Those unanticipated obstructions to his work, of which neither the engineers nor he had prior knowledge, resulted in substantial unanticipated costs to the contractor.

The first disposition of the municipal authorities was to require the contractor to meet the conditions as encountered, without added compensation. Further consideration resulted in the decision that although the total cost of the particular contract would be reduced by application of such a policy, future bid prices and contract costs on similar work would be substantially increased because all informed contractors would logically include in future bids allowances designed to take care of similar contingencies even though such contingencies might, in fact, not develop. Their anticipated cost, included in future bids, would nevertheless be paid for by the municipality. The final decision was that the contractor should be reimbursed for the unanticipated costs he had incurred.

In further considering the above example it may be noted that the cost of before-planning surveys adequate to determine the existence of all obstacles encountered by the contractor would have been prohibitively high. As it developed, the use of plans and specifications based on all reasonably available information, and application of the policy of reimbursing the contractor for the cost of meeting unanticipated conditions, actually resulted in a favorable finished job cost to the owner, with good assurance of fair pricing on future similar work.

Contractor Expected to Assume Risk

There are instances in which the owner prefers that the contractor assume the gamble described, and is willing to pay the additional cost resulting from that policy. Officials responsible for city, county or state work sometimes find that obtaining a higher appropriation in the beginning is easier than securing additional funds for a contract, even though the latter procedure would result in a lower final project cost. In some instances the provisions of municipal charters or of legislative requirements applicable to the public work concerned determine that the policy first referred to must be followed. However, it is not believed that such a policy contributes to the lowering of costs in the construction field.

BY THE END OF World War II our nation had accumulated a great reservoir of deferred construction. Our national economy will be vastly improved by the accomplishment of all such desirable projects. The engineering, the architectural, and the construction professions are dependent upon continued activity in the accomplishment of such projects.

Numerous other examples bearing on the point under discussion could be offered. Recently, in the Southeast, a substantial contract was awarded for the building of a structure supported by precast piles. For whatever reason, the owner and his engineers did not take the time or incur the expense of making adequate tests to determine subsoil conditions. The specifications called for a certain loading for each pile, to be computed by the application of an indicated formula. In a program of competitive bidding, no one of the prospective bidders themselves made adequate tests to determine subsoil conditions. The contract was awarded and completed, and analysis of the project costs indicates that the bids of the successful contractor, as well as of the competitive bidders, included allowances for maximum conditions which did not develop.

In this instance the complete project cost to the owner would undoubtedly have been less had the plans and specifications been based on adequate investigations, or had they provided a basis of additional compensation for costs resulting from conditions beyond those established as a basis for bidding. A further alternative, which apparently was not applied in this instance, would have been for the contractor to gamble on the development of favorable conditions, and to submit a correspond-

ASSUMPTION OF ENTIRE RESPONSIBILITY for unforeseen costs by contractor may result in higher total cost to owner. In photo above, huge boulders are encountered in stripping overburden on 3½-mile-long Potholes Dam project in Washington. Dam is one of three now under construction on Columbia Basin Reclamation Development. Photo below shows construction work under way on Horsetooth Dam, one of four earthfill structures that create $11,000,000 reservoir in Colorado–Big Thomson project. Reservoir basin is composed of eroded softer formations between uptilted sedimentary beds.

ingly low bid. The application of that principle might have saved money for the particular owner, but the policy is one of the best means of assuring that bonding companies will spend some of their money for the completion of construction jobs, and it does not make for lower prices in the industry.

"Civil Engineering" Articles on Subject

Recent issues of CIVIL ENGINEERING have carried articles bearing on the subject of this discussion which, because of the clarity of their statements, merit emphasis by repetition.

We find ourselves in substantial accord with the thoughts expressed by William A. Johnson, president of American Pipe & Construction Co. of Los Angeles, Calif., in an article entitled, "Construction Costs Can Be Cut," which appeared in the December 1946 issue of CIVIL ENGINEERING. He said, "If the contract system stumbles over this obstacle of excessive costs, government bureaus will seize upon this as an excuse to take over and perform all their own engineering and construction work. Furthermore, if this cost problem is not solved satisfactorily, and the bureaus move in, it may affect the political life and freedom of the individual. We may be working for the state instead of the state for us. I mean by this last that there seems to be a well-defined philosophy lurking here and there in our government which leans toward the abolishment of private initiative and industry."

A remedy suggested by Mr. Johnson is, "Take uncertainties out of the contract. Do not force the contractor to take all the risks. He will only be forced to add a safe contingency to his bid. You will get better bids if you let the owner take at least part of the unknown risks."

It is customary to insert clauses in the specifications that make the contractor responsible for any oversights on the part of the engineer, for any omissions in the plans or specifications, and for unforeseen conditions that may develop during the course of the construction. Unless one believes in crystal balls he must admit that if a contractor survives in the face of such provisions, it is because he has included in his bids allowances adequate to cover such contingencies, if and when they are encountered in his work. For he must meet them as they develop, either out of his personal resources or out of the proceeds of the estimate. Under the first policy it is a matter of time until he will go out of business. Under the second policy, owners, in the aggregate, pay more than the actual and proper costs. As a matter of basic principle, we believe that costs in the industry as a whole will be lowered if such conditions and clauses are omitted from specifications.

Generally Worded Clauses Unwise

Oren C. Herwitz, counselor at law in New York City, has encountered these problems in his legal practice, and in his work as Deputy Commissioner and Special Counsel to the Department of Public Works of the City of New York from 1940 to 1946. In the April 1947 issue of CIVIL ENGINEERING, he writes as follows:

"Though the soundness of the committee's conclusion is amply supported by the principles of natural justice, yet, regrettably, it is to be noted that in lump-sum contracts the general tendency has been to give this risk to the contractor. Most often the attempt is made by including in the contract generally worded clauses designed to protect the owner against additional liability should actual conditions prove to be different from those suggested by the preliminary subsurface data.

"Aside from all other considera-

tions, there are not only practical but also legal reasons why these generally worded clauses are unwise. Permit me to quote again from Manual 8: 'General clauses charging the contractor with the entire responsibility for unforeseen costs, besides being unfair, may also, unnecessarily, result in higher total cost to the owner, since the contractors may be expected to allow for these risks in their original bids and the owner will pay no matter whether or not they occur.' "

In that same article Mr. Herwitz relates instances and gives examples why such "protective" clauses should not be used. He also states that legal actions frequently determine that such clauses do not afford the protection they were designed to provide.

Mr. Herwitz presented another excellent article in the May 1947 issue of CIVIL ENGINEERING, in which he stated, "It is imperative that the owner's engineer use careful and precise language in the specifications to express what he has in mind. Regrettably, however, experience seems to indicate that engineers are often much less interested in the form of their specifications than in the substance. Their concern with substance rather than form is quite understandable; but it can, unfortunately, constitute a hazard to the owner's best interests."

Construction Costs Cut 60 Percent

The writers have been impressed with the results obtained by John P. Riley, director of development, of the New York City Housing Authority, as related in an article he presented in the May 1947 issue of CIVIL ENGINEERING. His interesting discussion includes the following:

OPEN MEETINGS with prospective bidders to discuss plans and specifications prevent errors and misunderstandings and reduce costs of New York City Housing Authority projects. Ten concrete frame buildings of 6-, 10- and 14-story James Weldon Johnson Houses, containing 1,310 apartments, are now under construction at estimated cost of $14,340,000.

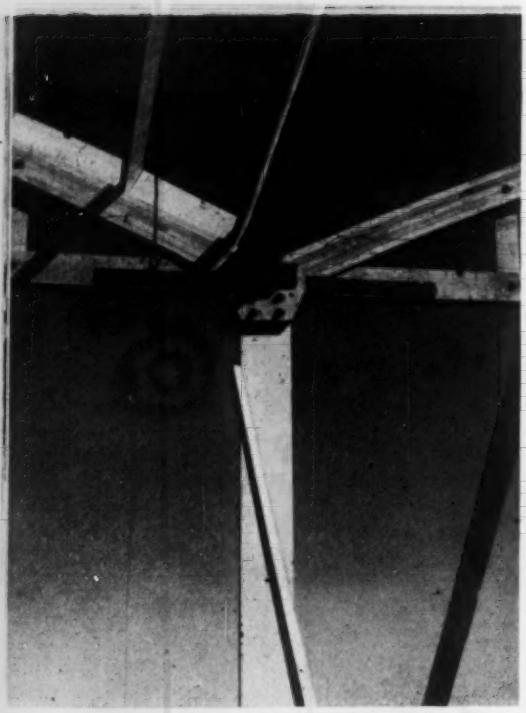
"What made it possible to cut construction costs 60 percent almost overnight? The reduction was the result of a very realistic and direct approach. Instead of specifications such as those written for monumental buildings and enforced by what are sometimes called the 'razor-blade, mirror and marble boys,' standards of design and construction, based on good commercial practice, were formulated and inspection—although thorough and efficient—was carried out for the good of the job and not for the glory of commas and semicolons in specifications. Secondly, all non-essentials were stripped from the design. Thirdly, prospective bidders were taken into the confidence of the owner, so to speak, by open meetings to discuss plans and specifications *before* bidding, to prevent errors and misunderstandings."

Those methods which Mr. Riley states were successfully adopted by the New York City Housing Authority can, with modifications based upon common sense and an understanding of the job in hand, be applied

(*Continued on page 82*)

Diver Handles Underwater Foundation Construction

UNDERWATER CONSTRUCTION utilizes services of deep-sea diver in placing 75 concrete footings for foundation of $1\frac{1}{4}$-million-dollar Carborundum Co. building at Niagara Falls, N.Y. Flooding of excavations by Niagara River—150 ft away and but 3 ft below ground level—requires removal of 10 to 12 ft of rock fill by clamshell bucket and air cleaning of remaining soft rock by diver. When sounding indicates bedrock is reached, diver places metal forms and concrete is poured by tremie method. Unusual construction expedient enables Turner Construction Co. to begin steel erection at early date.



DEVELOPMENT OF TIMBER design in past 20 years shows need for better trained engineers in this field. Pictured here is column connection for 50-ft bowstring truss with glued laminated top chord.

Advancement in Timber Mechanics and Design *Calls for* Specially Trained Engineers

HOWARD J. HANSEN, Assoc. M. ASCE

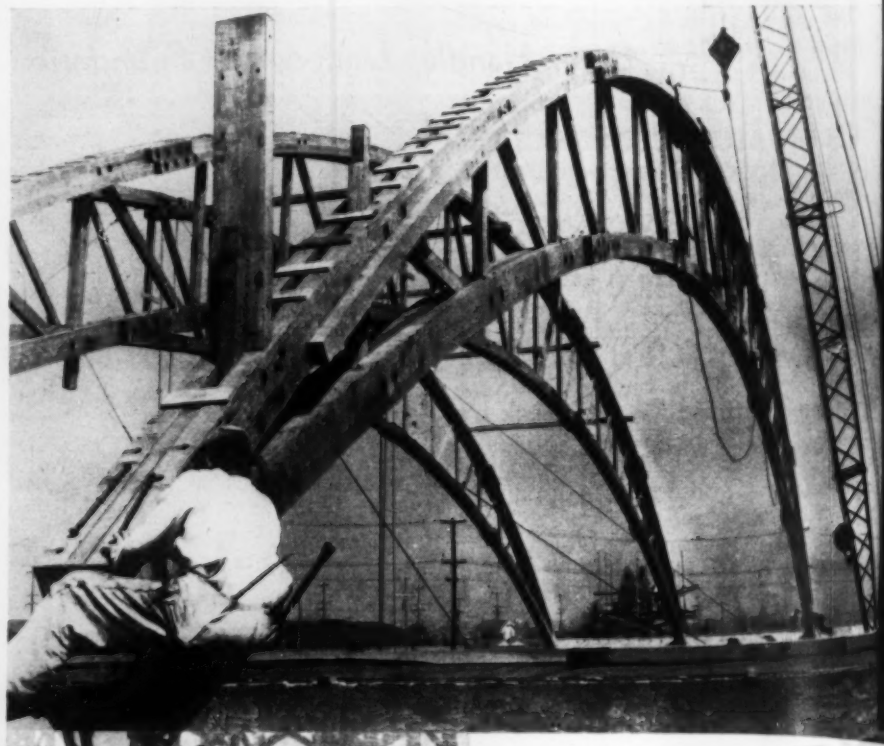
Professor of Mechanics; Acting Head, Industrial Engineering Department, University of Florida, Gainesville

DESIGN OF a rectangular wooden beam of a given span to carry a uniform load is the extent of the education in the mechanics of wood and timber design received by many civil engineering graduates. Twenty years ago there was plausible reason for the existence of such conditions, but today the picture has changed. Advancements in structural applications of wood over the past few years emphasize the need for comprehensive courses in timber design. Many progressive technical schools now teach these courses. For those schools that wish to add them to their curricula an outline of the subjects to be included in the elementary course in strength of materials and the items to be covered in a course on timber design are outlined herein. This paper was presented before the Structural Division at the Society's Fall Meeting in Jacksonville, Fla.

ONLY DURING the past 20 years have developments in timber mechanics permitted the same degree of accuracy and efficiency in wood design as in design of other materials. Prior to 1925 the only available information on the strength properties of American woods was that derived from approximately 130,000 tests on small clear specimens. These tests were conducted at the Forest Products Laboratory, Madison, Wis., and reported by J. A. Newlin and T. R. C. Wilson, M. ASCE. They were extremely valuable and later served as the basis for additional research, but they did not give the designing engineer a means of assigning working stresses to commercial structural sizes. Consequently, building codes differed widely and in some cases varied over 100 percent in allowable working stresses for the same grade and species of timber.

In 1925 Herbert Hoover, Hon. M. ASCE, who was then Secretary of Commerce, established the National Committee on Wood Utilization and secured for it the cooperation of the Forest Products Laboratory, which is maintained by the U.S. Department of Agriculture. Both the committee and the laboratory, with the assistance of the National Lumber Manufacturers Association, have since 1925 established uniform standards and design procedures which enable the engineer today to design in timber with the latitude and assurance comparable to that employed for other structural materials.

The first undertaking of the National Committee on Wood Utilization consisted of two studies by the Forest Products Laboratory, both published in 1930. The first was on the strength and related properties of woods grown in the United States by L. J. Markwardt. This series of tests together with supplementary investigations relating to the effect on strength of such variables as knots, cross grain, rate of growth checks, pitch pockets, and moisture content established a definite means of assigning safe working stresses for commercial structural grades of American species. The second series of tests, reported by J. A. Newlin and J. M. Gahagan, was on large timber columns. The results of these tests gave the designer a dependable formula for columns of intermediate length.



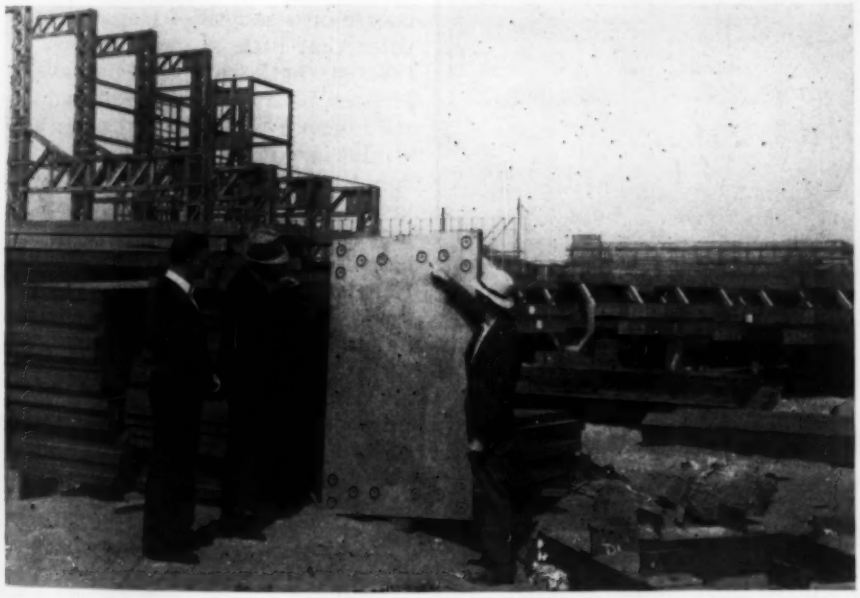
CRESCENT-TYPE roof trusses, 162 ft long, for U.S. Army B-29 hangar, feature glued-laminated chords and splice plates throughout. Use of crescent design in place of trusses with flat bottom chords permits lowering hangar walls 12 ft while furnishing sufficient inside clearance.

BOWSTRING TRUSSES of Home Mountain Air Base hangar, Idaho, have glued laminated top chords containing ten laminations of 2x6-in. lumber. Splice plates connecting three segments of top chords are also of glued laminated construction. Bottom chords are 6x12-in. solid timbers. Photograph shows setting of front 160-ft truss that carries hangar door guides. Note two assembled trusses in foreground.

In 1932 G. W. Trayer reported the results of tests on bolted joints. This report presented the basic stresses for the bearing value of all species when used with bolts, the method of applying these basic stresses to the design of bolted joints, and detail requirements for spacing, end and edge distance of bolts, in any joint.

The National Committee on Wood Utilization appointed Axel H. Oxholm, a noted timber engineer, as its director. He had considerable experience in Europe and brought to this country over 60 different types of timber connectors used by European engineers. These connectors were tested at the Forest Products Laboratory with native woods and the results published in 1933 by Nelson S. Perkins, Peter Landsem, Assoc. M. ASCE and G. W. Trayer. When in 1934 the committee was dissolved, the Timber Engineering Co. of Washington, D.C., a subsidiary of the National Lumber Manufacturers Association, acquired the patent rights on these connectors for the purpose of distributing them on a commercial basis. Since that time many additional tests, research projects, and refinements in manufacturing have been carried out.

Probably no single factor is more responsible for revolutionizing timber design than the development of modern timber connectors. Before their introduction into this country, bolts were used exclusively for joining members of a large structure, which necessitated the use of timber sizes beyond that needed for the design load in order to provide sufficient bearing area for the bolts. Connectors, which consist of metal rings or plates that are imbedded partly in each of adjacent members to transmit the load from one to the other, enlarge the bearing area of the joint stress, thereby making it possible in most cases to develop the full allowable loads of the members used. Formerly, timber structures designed with bolts only were conspicuous for their massiveness, but now, with a joint as strong as the timber itself, excess material can be eliminated.

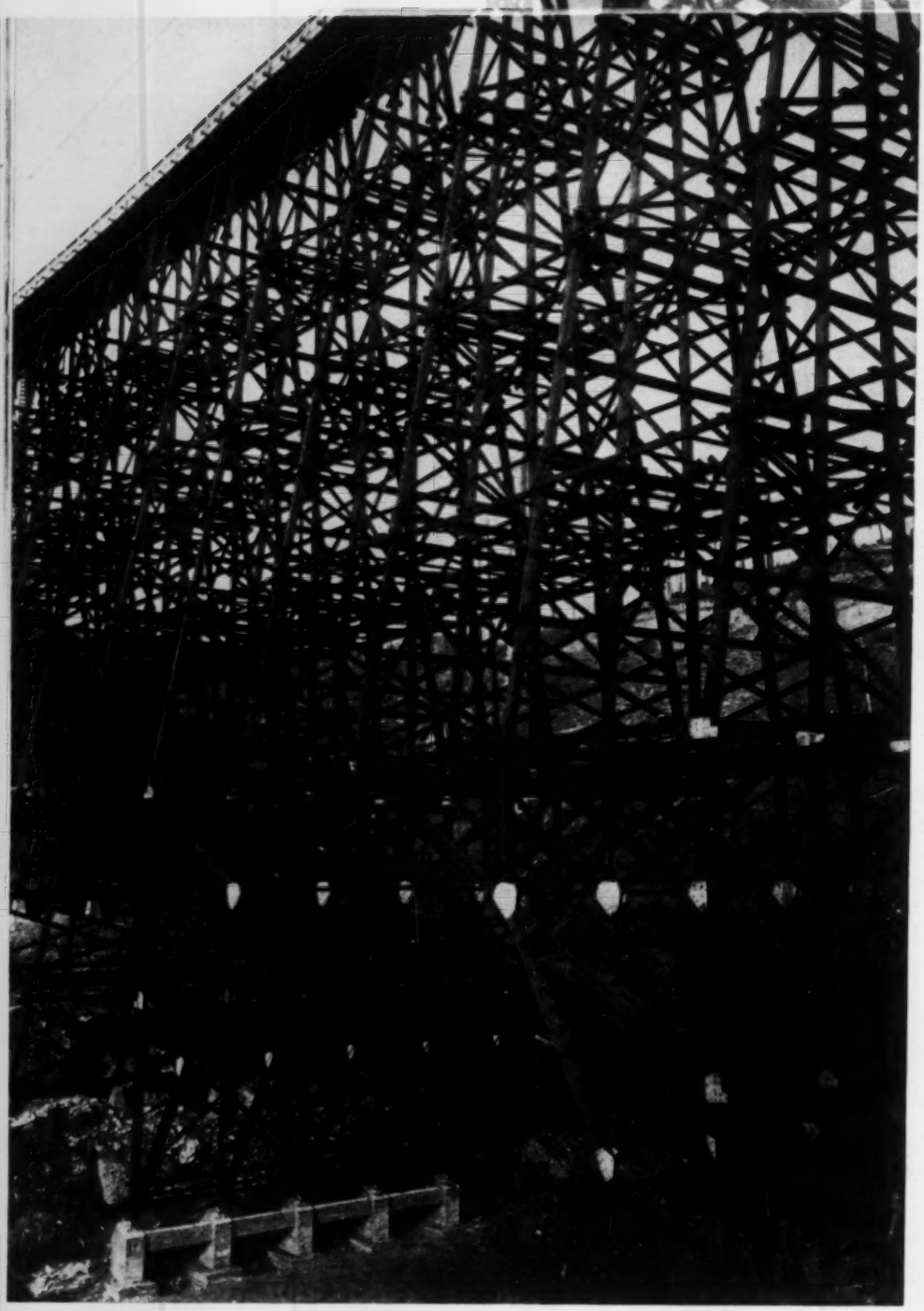


PLYWOOD WEB MEMBER, 3 in. thick, 6 ft long and 3 ft 8 1/2 in. high (as placed in column) is attached to outer posts by 2 1/2-in. split ring connectors. Shown under construction here is building at Golden Gate International Exposition, San Francisco, Calif.

Glued Laminated Construction

The comparatively recent use of glued laminated construction, through which wood can be bent into any required shape and built up into any required thickness and length, has opened up a vast field of construction possibilities. This is particularly true of arch construction, which has always been an important element in the structural and artistic design of buildings and bridges. Structurally an arch is a means of supporting loads between two supports. Earlier forms were built of masonry blocks, but these lacked strength in tension and had to be thick and heavy. Later, metals were used, and more recently reinforced concrete; but since research has been conducted at the Forest Products Laboratory on glued laminated construction, the use of wood in arches has become both efficient and economical.

There are many advantages in the use of glued laminated construction for wooden members, because it allows members to be built up from material that can be dried in a short time and that is too small to be structurally useful otherwise. Moreover, the members can be built up to larger cross sections and to lengths that are not readily available as single pieces. In arch construction no intricate framing is necessary; and the arch rib, which is a single cross section, has more fire resistance than a truss of smaller pieces designed to carry the same load.



BAIRD CREEK BRIDGE, built by Weyerhaeuser Timber Co. to reach timber reserves in Kalawa Basin, Wash., is 1,130 ft long and 235 ft high. Center section is three-hinged timber arch surmounted by frame bent superstructure 480 ft long. Compression joints in arch are filled with concrete pumped through holes in gusset plates to provide bearing for timber.

The results of tests at the Forest Products Laboratory have been presented in a booklet entitled, "The Glued Laminated Wooden Arch," by T. R. C. Wilson, M. ASCE, senior engineer, and published in 1939 by the U.S. Department of Agriculture. Also included in this booklet are the limitations in the design of glued laminated members, specifications for material and construction, design stresses, and the theory of the arch as it relates to the design and analysis of glued laminated arches.

Along with advancements in timber mechanics have come improvements in the manufacturing processes, grading, seasoning, and preservative treatments of lumber. Taken as a whole they have given the designer a structural material that has unlimited potentialities. It is true, of course, that wood has limitations as has any other material, and that there are still numerous problems to be solved concerning design methods; but an increased use of wood, which is in the interest of the general public, will aid in the development of new design procedures and other improvements.

With all these advancements in timber mechanics and design the question may be asked, "Is it feasible to omit an intelligent program of education in this field from the undergraduate engineering curricula today? It is true, of course, that many of our progressive technical schools are teaching courses in timber design, but a single course or a combined course of steel and timber design cannot cover the subject adequately.

Proposed Courses—Strength of Materials

All engineers take a course called strength, resistance, or mechanics of materials. Regardless of the name, this course is an elementary one dealing with the relationships between the loads acting on a member and the resulting stresses and deformations in the member. The word "materials" in the title is a misnomer because actually the course as taught deals with isotropic materials; and since wood does not have the same elastic properties in all directions it certainly cannot be classed as isotropic. It is my contention that the student should be introduced to the mechanics of wood in the course on strength of materials. It is true that along with the theory of the strength of materials most schools have a laboratory course in which a wood beam and several wood columns are tested, but this is insufficient instruction to give the student an adequate understanding of why wood under load behaves as it does.

It is unfortunate that the present texts on strength of materials do not devote much space to timber mechanics. A review of several of the most commonly used texts for the course on strength of materials indicates that little space is devoted to the strength properties, working stresses, behavior under load, and the relationship between stresses and strains in wood. Unless the instructor supplements the meager material given in these texts, the student is inadequately and in many cases incorrectly informed.

It is difficult to add courses to an already overcrowded curricula, and at present there is much being said for and against a complete revision of all engineering curricula pointing towards a five-year plan. Until this or some other form is generally adopted, it is proposed at the University of Florida to include in the elementary course on strength of materials the up-to-date information on wood and to cover the following subjects:

A. Mechanical and Related Properties of Wood

B. Methods of Testing Wood
C. Discussion of Grading Rules and Their Purpose
D. Design Stresses and Factors Governing Their Use
E. Beams
   1. Flexure
   2. Shear
   3. Bearing
   4. Deflection
   5. Form factors
F. Columns
   1. Solid
   2. Spaced
   3. Built-up
G. Compression at an Angle to Grain
H. Combined Stresses
   1. Tension and bending
   2. Compression and bending
   3. Compression or tension with eccentric loads

Structural Design

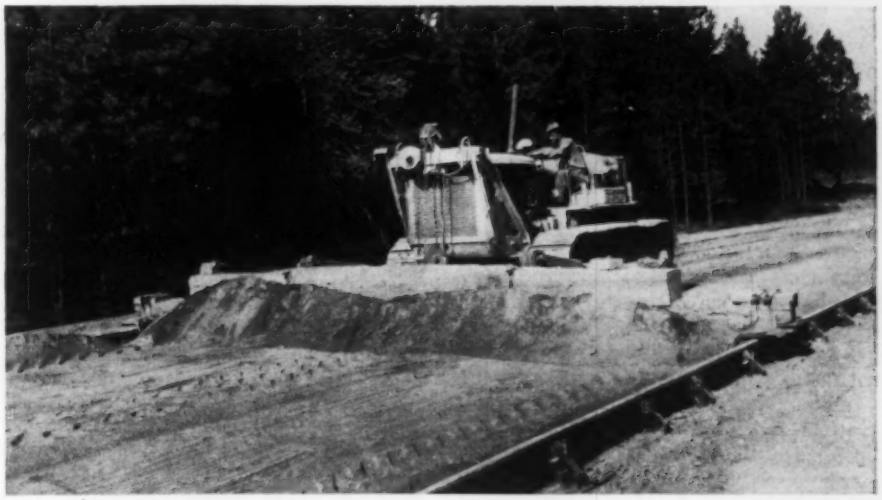
Once the student has grasped the basic factors that make wood different from other materials, and has a knowledge of the use of working stresses and formulas pertaining to wood, he is ready to begin the discussion of fastenings and the design of joints. The following outline contains the material that should be covered in a course on timber design in which three hours a week are devoted to lectures and three hours a week are devoted to a design period.

A. Joint Design
   1. Nails and spikes
   2. Driftpins
   3. Screws
   4. Bolts
   5. Lag screws
   6. Connectors
   7. Glue
   8. Strap and pin
   9. Rod and block
   10. Dapped and morticed
B. Design of Trusses
   1. Discussion of general framing methods
      a. Economical shape and member arrangement
      b. Span-depth ratios
      c. Panel-length to truss-depth ratios
      d. Available lumber sizes
      e. Heavy members for fire resistance
   2. Common types of framing and trusses used
   3. Joint details
   4. Camber
   5. Design of a typical bent for dead, snow, and wind loads.
C. Glued Laminated Construction
   1. Manufacture
   2. Specifications
   3. Design stresses and factors governing their use
   4. Design of a three-hinged glued laminated arch for dead, snow, and wind load
D. Timber Decks and Floor Systems
   1. Design of typical beam and girder bay
   2. Plank and laminated floors
   3. Timber-concrete composite decks
E. Douglas Fir Plywood
   1. Manufacture
   2. Grades and sizes
   3. Design stresses
   4. Strength properties
   5. Stressed-cover design
   6. Gusset plates
   7. Plywood girders
F. Forms
   1. Construction
   2. Design
G. Wood Preservation
   1. Treatments against decay and attack
   2. Construction details to prevent decay and attack
   3. Fire retardant treatments
   4. Specifications

(*Continued on page 82*)

WOOD HAS REACHED place of prominence in construction industry that demands inclusion of courses on this important structural material in engineering curricula. Glued laminated members pictured here form Gothic arch in construction of Army chapel at Abbott Field, Bend, Ore.

Tractor Substitutes for Grader on Idaho Highway



FINE GRADING IN PREPARATION FOR SURFACING 3.8-mile stretch of U.S. Highway 10 between Coeur d'Alene and Post Falls, Idaho, is accomplished by improvised grader. Grading blade, consisting of heavy 24-in. timbers fastened to bulldozer frame of Caterpillar D7 tractor and fitted with guide plates strap-bolted to timber ends, travels on firmly cleated steel rails which act as side forms for pavement. Equipment is owned by Sather & Sons of Spokane, Wash., contractors on job.

PURPOSE OF NEW Building Research Advisory Board is to point way to higher quality construction at lower unit costs. Here, movable form on steel wheels riding on rails anchored to concrete slab permits fast and economical construction of concrete roof sections for Kansas City plant of Pratt and Whitney Aircraft.

Building Research Advisory Board Promotes Development in Building Construction

R. H. TATLOW, III, M. ASCE

President, Abbott, Merkt & Co., Inc., Consulting Engineers, New York, N.Y.

ORGANIZATION, OBJECTIVES and methods of operation of the Building Research Advisory Board—created by the National Academy of Sciences through its National Research Council—were explained in the August 1947 issue of CIVIL ENGINEERING by J. C. Stevens, Past-President ASCE. The article that follows, based on a paper presented before the ASCE Construction Division at the Fall Meeting of the Society in Jacksonville, Fla., emphasizes the need for research facilities in the building construction industry and tells how the Building Research Advisory Board can help meet these needs.

FOR YEARS there has been an increasing belief by well-informed persons that the construction industry should be more intimately knit into one effective group. The most recent approach has been through the formation, two years ago, of the Construction Industry Advisory Council. This was brought about by the heads of numerous agencies, but particularly through the efforts of F. Stuart Fitzpatrick's Construction and Civic Development Committee of the U.S. Chamber of Commerce.

One of the early moves of the Council was to investigate research activities. As a result, it prevailed upon the National Academy of Sciences, which was established by Congress in 1863, to agree to create through its National Research Council a Building Research Advisory Board. Notice the two qualifying words—"building," because to include heavy construction called for too large an initial undertaking; and "advisory," because the Board should never attempt to duplicate existing activities and to conduct fundamental research.

The Building Research Advisory Board is purposely not to be a government body, although it will be in a position to benefit from its close relation to government through its parent organization, the National Research Council, which operates under an executive order as the research agency of the National Academy of Sciences. It is a neutral unbiased organization representing through its various members the entire building construction industry. The general pattern is already well established by

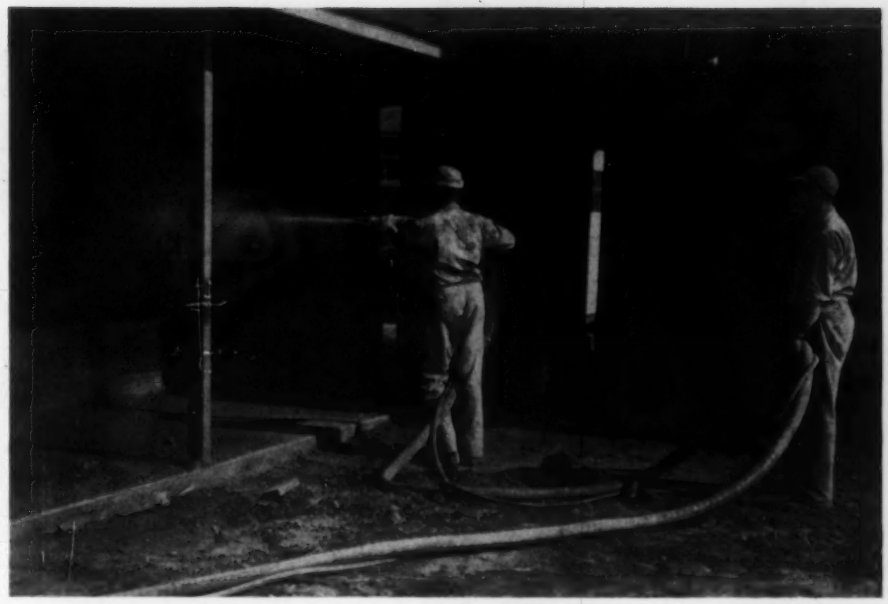
NEW DESIGN CONCEPTS and construction techniques can be expected as a result of program of newly formed Building Research Advisory Board. In photo, welder fuses second-story floor beams and girders in constructing addition to Lincoln Electric Co. plant in Cleveland. Structural steel weighing 1,314 tons is welded into one rigid frame for this 200,000-sq ft industrial building.

the very effective Highway Research Board.

The Highway Research Board is an organization representing the many groups interested in highway development. This Board has an executive committee under which a permanent staff is employed. Some 35 or 40 member organizations have representatives who meet with the dozens of committees and subcommittees. The Board keeps the member organizations informed of all significant developments relating to highways. It aids, encourages, coordinates and disseminates information on highway research. It has done a splendid job and its great value has been widely recognized.

Funds Are Needed

Several months ago a general prospectus setting forth the aims, objectives and mode of operation of the Board was prepared and circulated to interested groups for comment. Since that time the ASCE and about 20 others have offered suggestions. An investigator has traveled over the United States and contacted many research agencies, and then has reported his findings. As a result, the staff of the National Research Council is now revising the prospectus which will serve as a basis for negotiations with all of the construction industry for funds. Money is required before a formal program can be established and anything constructive actually done. To date there has been no meeting and there cannot be until funds are on hand. The National Research Council hopes for an organization meeting in November 1947.



BUILDING FIELD OFFERS many opportunities for research in development of new materials and construction procedures. Here, standard stucco methods are discarded for speedier application of material by cement gun at Kaiser Community Homes project in San Fernando Valley, California. System enables crew of 13 to finish three houses daily.

Briefly, the over-all purpose of the research program is to point the way toward higher quality construction with better service to the public at lower unit costs. As presently conceived, the Board will:

1. List, review and correlate the results of research already completed.
2. List, review and correlate current research.
3. Disseminate information so obtained.
4. Sponsor forum discussion of research aims and results.
5. Coordinate research effort and actively sponsor elimination of needless duplication.
6. Foster research in relatively undeveloped fields.
7. Generally further the application of scientific methods for the improvement of building construction practices.

According to Webster, "research" means: "(1) Careful search; a close searching; (2) studious inquiry, usually critical and exhaustive investigation or experimentation having for its aim the revision of accepted conclusions, in the light of newly discovered facts."

Since the Board is not yet organized, its future work has not been decided. However, some of the possibilities in the many fertile fields for

TWENTY-TWO OUTSTANDING LEADERS in the building industry and its related research have agreed to serve, without pay, as a purely advisory group known as the Building Research Advisory Board. Dr. Frank B. Jewett, an eminent scientist who for many years headed the Bell Telephone Laboratories, and who until recently was president of the National Academy of Sciences, has accepted the chairmanship of this new body.

The members are:

Frank B. Jewett, chairman, Building Research Advisory Board

Carl F. Boester, director, Housing Research Division, Purdue Research Foundation

John E. Burchard, director, Bemis Foundation, MIT

Hugh L. Dryden, director, aeronautical research, NACA

Charles H. Herty, Jr., assistant to vice-president, Bethlehem Steel Co.

J. E. Hobson, director, Armour Research Foundation

George M. Hunt, director, Forest Products Laboratory, U.S. Department of Agriculture

R. G. Kimball, director, technical services, National Lumber Manufacturers Association

H. H. Morgan, vice-president & chief engineer, Robert W. Hunt Co.

Judd Payne, vice-president, *Architectural Record*

Harry C. Plummer, director, engineering & research, Structural Clay Products Institute

G. M. Rapp, assistant director, Housing Research Division, John B. Pierce Foundation

C. F. Rassweiler, vice-president, in charge of research and development, Johns-Manville Corp.

W. E. Reynolds, commissioner, Public Buildings Administration

Tyler S. Rogers, president, Producers' Council, Inc.

William H. Scheick, coordinator, Small Homes Council, University of Illinois

Walter A. Taylor, director, Research & Education, American Institute of Architects

Elmer K. Timby, chairman, Department of Civil Engineering, Princeton University

Charles H. Tompkins, president, Charles H. Tompkins Co.

Thomas H. Urdahl, Urdahl and Everetts

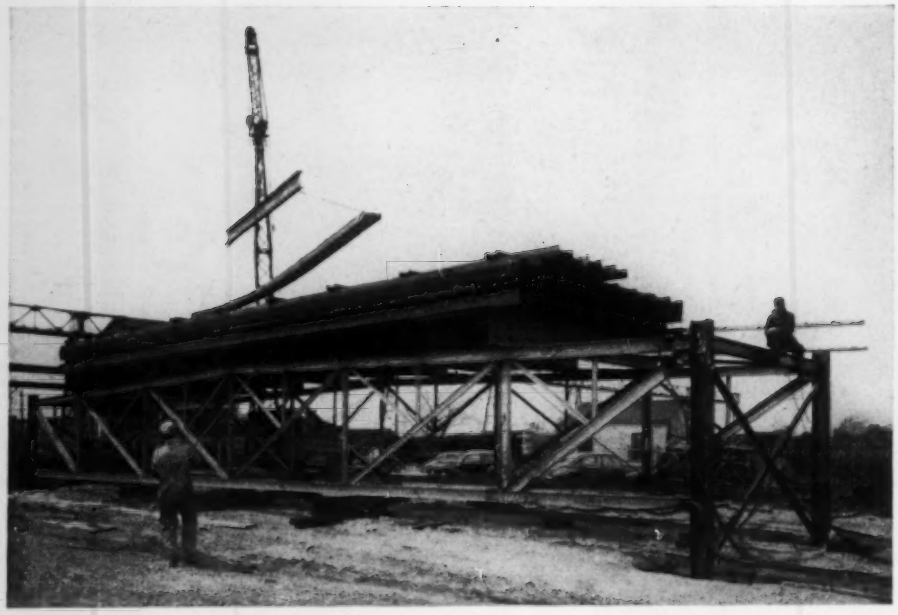
Harold Vagtborg, president, Midwest Research Foundation

Wallace Waterfall, director of research, Celotex Corp.

Ex Officio:

Detlev W. Bronk, chairman, National Research Council

Frederick M. Feiker, chairman, Division of Engineering & Industrial Research, NRC



NEW CONSTRUCTION Research Board operates in advisory capacity and does not attempt to duplicate existing activities or conduct fundamental research. It will collect and disseminate research data from all possible sources. Pictured here are two 80-ft welded H-section trusses under test load of 254,000 lb. Tests were conducted by Austin Co. to determine flow of stresses through truss joints. Some of the 144 strain gages used to record stresses can be seen in picture.

building research are suggested: (1) Modular construction is in its infancy. In New York the Tischman Building uses it to advantage. (2) Wall sections are being introduced to serve as inner and outer surfaces with self-contained insulation, the entire wall being 2 in. thick instead of 12 in. Use of large stone sections has been tried again. Many buildings are now being constructed without windows; the advantages are many, but will this trend grow? What about walls laid by special machines? (3) Fireproofing has had much attention and new materials are lessening loads to be carried. (4) New materials and special alloys may give us better frames. Buildings may be possible without columns by having roofs held up by a small internal air pressure. Inflated forms for concrete shells might change our conception of concrete forms. (5) Lighting. (6) Heating: underfloor radiant; package units; use of ground heat; electronics. (7) Air conditioning, high-pressure ducts, maybe a type of construction to eliminate much duct work; use of low ground temperatures. (8) Paint. (9) Bathrooms and kitchens made in complete form by stampings. (10) Glazing. (11) Maximum use of all materials—composite beams. (12) Incentive plans for labor. (13) The annual wage. (14) Space utilization.

The Board might recommend and help establish standard practices, or assist in the dissemination of manuals of recommended practice for varying conditions. This might give architects, engineers and builders a better basis for making their decisions and give competing salesmen who extol the merits of their products some factual information.

As an example, what are the relative merits of pressed steel members versus wood in light construction such as housing? Wood studs are more conventional, but under what circumstances would steel be the better design, such as labor costs of the trades concerned, accessibility to the product, climate, length of construction season and availability of sizes and connections?

Again, where should the various types of roof insulation be used and what should be the measure of their success? A twenty-year roofing guarantee will not pay for replacing insulation when it has rotted. How much expense is justified to provide a vermin-proof and waterproof insulation that will be unaffected by leakage? How much time is lost during installation by waiting for the insulating material to dry out before laying the roof, and how much does that cost the contractor and ultimately the owner?

Practices regarding plaster on the interior of masonry walls differ widely between regions with almost identical climatic conditions. Some designers specify furred walls; some parge the walls; others use cavity-type wall construction; and still others believe they are obtaining the workmanship necessary to provide the required resistance to moisture penetration. Upon what do you base your decisions other than your own necessarily limited experience together with that of practice in your locality?

New Materials Should Be Encouraged

Compiling past experience on materials and procedures is only a start. It is still necessary, perhaps now more than ever before, to encourage manu-

LARGE HOUSING PROJECT at Harundale, 5 miles south of Baltimore, uses assembly-line methods and special equipment in constructing 1,200 low-cost homes. Warner & Swasey Gradall machine, pictured here lifting chunk of frozen earth, is typical of many new types of machines that are proving to be cost-reducing factor in building construction.

RELATIVE MERITS of various construction materials and methods will be considered by the Building Research Advisory Board. Here, 18-in.-dia pipe columns with $^3/_8$-in. wall thickness (left) give increased rigidity in supporting I-beam runway for 40-ton crane in plant of Milwaukee Crane & Service Co., Milwaukee, Wis. To add further stiffness and obtain supporting members for roof (right), I-beams are welded to column.

facturers to produce new materials, and designers and contractors to devise new methods for using them more effectively. Manufacturers quite properly want, in the end, to see a profit from any new product and when they are making a good profit on an old item they are naturally reluctant to gamble on a new development. On the other hand, the engineer does not relish being a guinea pig to conduct experiments with his client's funds. Thus we have the manufacturer waiting for an item to be specified and the engineer waiting for a proven product.

Modular coordination, modular design and modular products are about in this spot today. Many manufacturers, not being assured of an unprejudiced market, hesitate to convert to modular products at a substantial initial cost; the designer is loath to specify modular products for fear his client will bear an undue proportion of this initial cost; and the contractor, lacking in modular experience, refrains from a lower bid. Development or investigation, acceptance and recommendation by a body concerned with total over-all construction costs and systems should provide the impetus essential to the sponsorship of new products or methods without embarrassment to or undue burden on a few forward looking members of the profession.

Production, handling, transportation and merchandising of building materials, as well as their placement in the structure, are a few other considerations which greatly influence the economy of building. The path that lumber takes from the tree to the building for example involves operations, many of which are fundamentally the same as those that have been in use for generations. The power saw, the heavy tractor and truck have greatly facilitated this operation, and the packaging of dimension lumber and mill work makes it unnecessary to unload lumber at the building site stick by stick. Handling brick and other small materials is costly. Research in labor-saving devices is urgently needed. There is obviously room for much improvement. Think of the improvements that have been made in the mixing, transportation and placing of concrete, and yet there are many items in this operation that can probably be improved in the interest of economy and a better structure.

Unfortunately, improved materials, methods of placement, and other advancements which the Board may develop will be largely nullified, as far as economy of erection is concerned, unless at the same time restrictive limitations on labor uses and productivity are abandoned. This is one of the industry's greatest problems, in fact one of the nation's most critical problems. The Board must recognize this very real problem even though it is not the proper agency to work on it.

The Board certainly will not write specifications or codes, but it should be the agency for aiding in their development and for backing up the writers of uniform codes. Code troubles are so obvious to those who work under them that they need no other emphasis.

Type of Organization

Organizational problems will be the first to be considered by the Board. Some of the more prominent possibilities for the top divisions might be on the basis of:

I. Operations, such as: (1) design, (2) materials, (3) construction methods, (4) equipment, (5) statistical, (6) administration and management.

II. Function, such as: (1) architectural, (2) mechanical, (3) structural, (4) electrical, (5) records.

III. Character, such as: (1) housing, (2) commercial buildings, (3) industrial buildings, (4) institutional buildings, (5) records.

No doubt the Board will consider these divisions and many others, selecting those which best fit the requirements. In any event, the organization will primarily be operating at staff levels, and it would seem that the breakdown on the basis of operation would be the most satisfactory over a long period. For collating, a direct operation is involved. For the study of new projects, arrangements will have to be made within the vast framework of existing private and public organizations.

Part Played by Engineers

Engineering is a far more important and influential partner in building construction than most engineers realize. It is interesting here to observe that eleven members of the Building Research Advisory Board are members of the principal engineering societies.

With respect to design, the engineer's part varies from almost nothing in the individual house to 100 percent in the modern industrial plant. But all buildings must be planned, financed, erected, operated and insured, and the engineer is active in most of these phases.

It is of interest to civil engineers that the Board will confine its activities to *building* construction such as houses, factories, hospitals, hotels and office buildings and will not cover

(*Continued on page 82*)

Engineers' Notebook

Simplified Designs Facilitate Pitot Tube Application to Small Pipes

CARL E. KINDSVATER, ASSOC. M. ASCE

Associate Professor of Civil Engineering, Georgia School of Technology, Atlanta, Ga.

IN MOST LABORATORY or field investigations involving the flow of fluids in pipes, measurements of pressure and velocity are of primary concern. Where point velocities or velocity traverses are of interest, the pitot tube or combination pitot-static tube is most frequently used. Pressure determinations alone are most frequently obtained from a single wall piezometer or a manifolded ring of piezometers. For small pipes (under 12 in. in diameter) such as commonly are encountered in the laboratory, satisfactory pitot tubes are either not procurable or are so expensive as to be prohibitive for all but special applications. The "home-made" product is frequently of such elaborate design as to impose similar limitations.

Piezometers, on the other hand, are relatively easy and inexpensive to construct, but too frequently are not entirely satisfactory for precise work. For high-velocity flows, piezometers are particularly inadequate, and the use of two or more piezometers at a pipe cross section is required only because of the inexplicable errors which characterize the most painstakingly constructed individual piezometers.

There are particular instances where piezometers are of almost no use. Thus, if the piezometer section is downstream from a rough joint or boundary irregularity; if the pipe walls are formed by lap-weld, spiral, or riveted longitudinal joints; or if the boundaries are particularly rough or corrugated, it is advisable not to use wall piezometers for pressure measurements. Likewise, if the pipe in question is not readily accessible; if it is a permanent element of a fixed pipe system or one that cannot be taken out of service, the problem of installing the piezometers is further complicated. In the writer's experience, consistently good piezometers are exceedingly rare.

Many of the aforementioned problems are believed to have been overcome in the development of simplified pitot, pitot-static, and static tubes for laboratory applications on pipes of small size. The basic proportions of these tubes were derived from information contained in the National Advisory Committee for Aeronautics' Technical Note No. 546, "Comparative Tests of Pitot-Static Tubes," by Kenneth G. Merriam and Ellis R. Spaulding. Figure 1 shows both a pitot-static tube and a static tube of simplified design. It is estimated that after the first exploratory models were constructed, not more than 3 hours of a skilled mechanic's time and appoximately 50 cents worth of materials were expended on each additional pitot-static tube. The static tubes were less expensive.

The application of static tubes to the measurement of pressures has hitherto been largely confined to aeronautical research. Applications to hydraulic research have been retarded by considerations of expense and mechanical difficulties rather than by shortcomings of the instrument itself. Properly used, the static tube may be expected to yield more consistently accurate determinations of pressures than individual wall piezometers. Furthermore, it has the advantage of being portable, of being capable of traversing the entire flow cross section, and of escaping the effects of wall protuberances.

The simplified pitot tubes illustrated in Fig. 1 were developed for the hydraulics laboratory at the Georgia School of Technology. Here the basic water-circulation system has been provided with flanged-joint, spiral-weld, 10-gage steel pipe. A program is now under way to equip

(*Continued on page 82*)

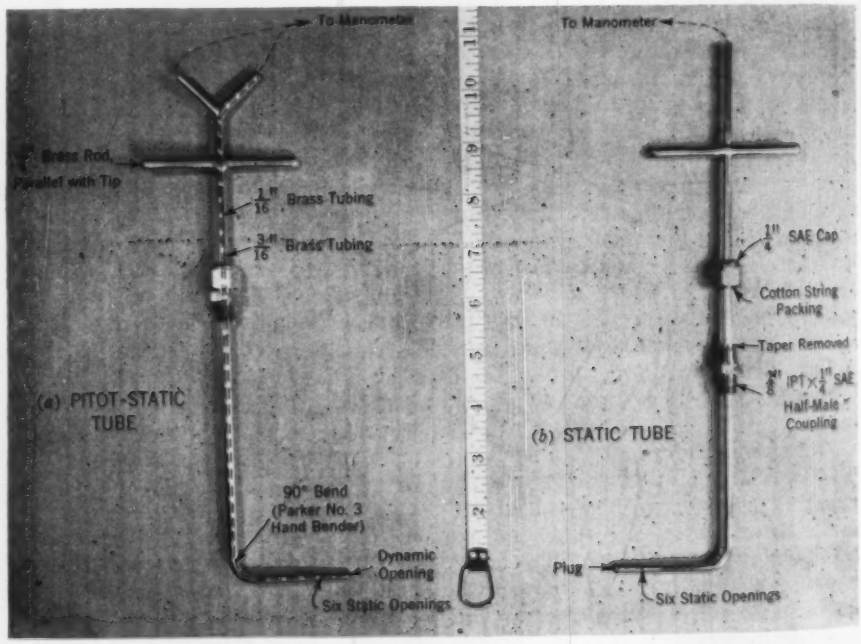


FIG. 1. INEXPENSIVELY CONSTRUCTED pitot-static tube (left) takes skilled mechanic not more than 3 hours to make, once exploratory model has been constructed. Static tube (right) takes even less time to make.

...THE READERS Write

Lists Eleven Engineer Members of U.S. Congress

DEAR SIR: In William Goldsmith's article, "Politics Needs Engineers," in the August issue, he states that as of April 25, 1947, there were three engineers in the United States Congress—two in the Senate and one in the House. Fortunately, that number was higher, although it is still far from enough.

Engineers and architects in Congress as of about that date were as follows:

REP. GEORGE P. MILLER, of California, who holds a B.S. degree in civil engineering from St. Mary's College and served as executive secretary to the California Division of Fish and Game, 1941–1944.

REP. GORDON L. MCDONOUGH, also of California, an industrial chemist who specialized in metallurgy and explosives manufacturing.

REP. CARL HINSHAW, Assoc. M. ASCE, also of California, a 1916 civil engineering graduate from Princeton, who was engaged in the real estate and insurance business before entering Congress.

SEN. CLAYTON D. BUCK, of Delaware, chief engineer of the Delaware State Highway Department from 1927–1929.

SEN. MILLARD E. TYDINGS, of Maryland, who holds a mechanical engineering degree from the University of Maryland, is also a lawyer, and was first elected to the Senate in 1926.

SEN. GEORGE W. MALONE, of Nevada, 1917 engineer graduate of the University of Nevada.

REP. JAMES H. HEFFERMAN, of New York, who holds a degree in architecture from the University of the State of New York, and has served as a member of the New York and Brooklyn Society of Architects and Council of Registered Architects.

REP. FREDERICK A. MUHLENBERG, of Pennsylvania, 1912 University of Pennsylvania graduate with a B.S.A. degree, recipient of a doctor of science degree from Muhlenberg College, a practicing architect, and a member of the American Institute of Architects.

REP. AUGUSTINE B. KELLEY, of Pennsylvania, graduate of the U.S. Military Academy and member of the American Institute of Mining and Metallurgical Engineers who worked in mining engineering, 1907–1912.

SEN. RALPH E. FLANDERS, of Vermont, engineer with 50 years of experience in the machine tool industry.

REP. PAUL B. DAGUE, of Pennsylvania, an electrical engineering graduate of Drexel Institute.

My work as Washington editor for *Engineering News-Record* and *Construction Methods* convinces me that the number of engineers in Congress is far from sufficient at this time. In view of the tremendous costs of the engineering programs the various federal agencies are carrying out, I am in full agreement with Mr. Goldsmith's views. It is good to report that the work of the men listed is praiseworthy and that these men have demonstrated the ability of the engineer to carry the great responsibility and honor of being elected to Congress.

ARCHIE N. CARTER., Assoc. M. ASCE

Washington, D.C.

Long Affiliation with ASCE Is Recalled

DEAR SIR: On October 5, 1897, in my 19th year, I was elected a Junior in the American Society of Civil Engineers. I feel very proud of having been admitted at that age; and also feel exceptionally proud that I am now celebrating the 50th anniversary of ASCE membership. I claim the distinction of being one of the youngest—if not the youngest—Junior ever admitted and, until proved wrong, will rest on my laurels.

Well do I remember my first and last meeting at the old Society Headquarters, 127 East 23rd Street, New York City, and the formal opening of the new headquarters at 220 West 57th Street, on November 24, 1897, with President Benjamin Morgan Harrod, of New Orleans, La., presiding. The ceremonies were opened with a dedicatory prayer by the Rt. Reverend Henry C. Potter, and addresses were made by Gen. William Price Craighill, Past-President and Honorary Member, J. G. Schurman, president of Cornell University, and the Hon. Joseph H. Choate.

Looking backward with great pleasure on my many years of affiliation in the Society, it would be very difficult for me to express in a few words the many benefits derived from association with those in the same profession and the same field of interest and from the vast amount of engineering literature received in the Society publications.

In my opinion, among the many factors that have contributed to the present greatness of our Society has been the splendid work of our Technical Division committees, in establishing theories, standardizing engineering practice, and maintaining ethical standards.

Incidentally, I still have in my possession the official letters from the late ASCE Secretary Charles Warren Hunt, notifying me of my election as Junior on October 5, 1897, and as an Associate (now Affiliate) on May 3, 1910, which I shall keep as cherished mementoes.

THEODORE BELZNER
Affiliate ASCE

Brooklyn N.Y.

Engineers Should Be Politically Educated

DEAR SIR: Mr. Goldsmith's article, "Politics Needs Engineers," in the August number, is timely in putting before engineers the challenge that must be met if they are to take their place in the solution of the world's problems.

As pointed out by the author, the nature of the engineering profession is somewhat at fault for the engineer's lack of active participation in politics—"Engineering is concerned primarily with things, not with people." This premise can be carried still further: Engineering is concerned with demonstrable facts, and is based on logic; politics, although actually concerned with facts, has its motives and conclusions obscured by partisan oratory, and the dominating factor in politics is the ability to sway the public mind by appeal to the emotions.

The place to awaken engineers to the need of making their presence felt in politics is in the schools and colleges, if classes in current affairs, civic awareness, economics, and the like can be squeezed into the time-consuming technical curriculum of the engineering student. There *is* a definite challenge, there *is* a definite need. Here is the place to begin development of engineers capable of being developed.

Although the present survey reflecting on the administrative and legislative capabilities of engineers (3 engineers to 303 lawyers in the Senate and House) is illuminating, it represents a very old state of affairs. It was 170 years ago that Thomas Jefferson said, "I served with

General Washington in the legislature of Virginia, with Dr. Franklin in Congress. I never heard either of them speak ten minutes at a time, nor to any but the main point, which was to decide the question.

"They laid their shoulders to the great points, knowing that the little ones would follow of themselves. If the present Congress errs in too much talking, how can it be otherwise, in a body to which the people send one hundred fifty lawyers whose trade it is to question everything, yield nothing, and talk by the hour. That one hundred and fifty lawyers should do business together ought not to be expected."

Washington was an ex-surveyor, Franklin an inventor-engineer; they had the faculty of sticking to "the main points." Let engineers take heed and meet the challenge. Politics may not *want* them, but it does *need* some of what they have to offer. For those capable and favored with the opportunity for service, let the goal be good *statesmanship*, not merely good *politics*.

ERIC FLEMING, M. ASCE
New Brunswick, N.J.

Objects to Proposed ASCE Grade of Fellow

TO THE EDITOR: With one exception, the proposed changes in ASCE membership grades, outlined in the July issue, seem like a step forward. That exception is the proposed designation of "Fellow."

The membership grades should be selected for the effect they will have on the general public, the ones who employ engineers. To the public at large, a "fellow" is a person who doesn't amount to much and is not to be trusted too far. The designation seems entirely out of keeping for the type of man expected to have the title.

As a matter of fact, it has always seemed to me that the entire engineering profession belittles itself with the titles it uses. We have Directors of Sales, General Sales Managers, Regional Sales managers, and Zone Managers. All the engineering profession has to offer are such designations as Chief Engineer, Engineer, and Assistant Engineer. To one in the profession, these titles are sufficient, but the public has no conception of the authority and responsibility that go with the jobs.

Just as a guide, I suggest Master Engineer, Engineering Director, Directing Engineer, Senior Engineer, or some other word denoting "super."

I have spent about half my career in selling and the other half in engineering and administration. The knowledge required in engineering and administration is far greater than that required in selling. Yet the relative importance of the two, in the minds of non-engineers, together with the money return, places the engineer away below the salesman. The titles common to the two professions confirm the public in its judgment.

JAMES E. PAYNE, Assoc. M. ASCE
Lansing, Mich.

Maintenance of Hydraulic Structures Is Described

TO THE EDITOR: The Northern States Power Co. in Minneapolis has some 30 hydraulic structures (hydroelectric plants and reservoir dams) exposed to much the same climate described by Mr. Giesecke in his article in the October issue. All these structures were built prior to 1928, and the major concrete structures were built in the period, 1905–1928. Our experience in the maintenance of the structures varies only slightly from that outlined by Mr. Giesecke.

It is noteworthy that the first major repairs to plants constructed between 1905 and 1916, were made from 5 to 18 years after construction. These first repairs were invariably to the concrete in the powerhouse tailrace, which is exposed to frequent cycles of freezing and thawing during cold weather because of the daily changes of water level. First major repairs to the heavier concrete in the dams at the same plants were made 10 to 39 years after construction. In many instances, severe disintegration was evident by this time. In the case of plates constructed between 1922 and 1928, now 19 to 25 years old, no major repairs have yet been decided upon, though disintegration of the concrete in the most exposed portions of these structures is in progress.

These periods of construction represent two phases in concreting technique. The first period (1905–1916) was the era of chuted concrete and bank run aggregates; the second marks the beginning of understanding of the factors involved in making durable concrete. Our experience indicates that a big step forward was taken between 1916 and 1922.

In general, our methods of repair are similar to those described by Mr. Giesecke. Every effort has been made to obtain strong, dense and impervious concrete, in accordance with current recommended procedure. Experience has taught us that it is futile to place thin undoweled, or lightly reinforced, concrete on old surfaces. The new concrete must have a substantial body, must be reinforced and, above all, must be securely doweled to the old concrete. We use 6-in. minimum thicknesses of new concrete over old, but only when the dimensions of the old structure do not permit greater thickness of the repair concrete. We prefer a minimum thickness of 18 in., and this minimum is adhered to in all massive work, as on the spillway sections of gravity dams. In such instances, our practice agrees with Mr. Giesecke's in the use of 1-in. dowels on 3-ft centers, well anchored in both old and new work.

In the case of tailrace piers, where the daily fluctuation of water level results in frequent freezing and thawing, we too have experimented with steel-covered concrete, and with various concretes of high density and extremely low water cement ratio. These methods have all been relatively effective. Good concrete placed in such locations in 1925 and subsequently gives indication of a useful life of 30 years or more.

The slabs of reinforced dams and the walls of scroll cases present special problems. In such instances, relatively thin concrete members, 18 to 48 in. thick, are exposed to water pressure on one side and to ambient temperatures on the other side. Poor concrete in such exposures has required repair as soon as 14 years after construction. We have attacked these problems by: (1) repair or reinforcement, (2) waterproofing, and (3) housing to prevent freezing. In some instances, all three methods have been combined.

Waterproofing of scroll cases has been accomplished by internal lining with 1½ in. of Gunite. As an experiment, one bay of a reinforced concrete dam, which had disintegrated to a considerable extent, was grouted with calcium chloride and sodium silicate. This method of grouting was effective in stopping seepage through the slab, though not, in our opinion, to a degree to make the slab appreciably more resistant to freezing and thawing than it had been.

We have adopted, as a general procedure, the housing of thin members subjected to water pressure to prevent their freezing. This is considered an essential in the case of all thin concrete which shows signs of seepage. We have thus enclosed the exposed bays of flat-slab dams, and the exposed faces of scroll cases, using wood or Transite as the covering. The efficacy of this method is apparent in several of our older flat-slab dams, where certain bays were housed from the start and others were exposed. The exposed bays invariably show some degree of disintegration, while in the enclosed bays the concrete remains sound.

G. E. LOUGHLAND, Assoc. M. ASCE
Asst. to First Vice-Pres., Northern States Power Co.; and

HIBBERT M. HILL, M. ASCE
Hydraulic Engr., Northern States Power Co.

Minneapolis, Minn.

SOCIETY NEWS

Jacksonville Presents an Outstanding Program

HURRICANES FAIL TO DETER FLORIDA VISITORS

A FULL-FLEDGED variety program presented by the Florida Section attracted over 500 members and guests to the Fall Meeting of ASCE in Jacksonville. Conferences, Division sessions and carefully planned programs of sociability drew the large attendance, though hurricanes raged in the vicinity of the convention city at the outset of the meeting.

Technical Sessions Capture Interest

The numerous papers and discussions presented at the sessions of six Technical Divisions dealt largely with the timely engineering problems of the southeastern United States. Typical of these was the symposium on tidal rivers sponsored by the Waterways Division. Each of these Division meetings is reported in this issue of CIVIL ENGINEERING (pages13–17). City Planning, Construction, Highways, Sanitary Engineering, Structural and Waterways all held sessions during the first two days of the meeting. Lively discussion by the many engineers attending these sessions indicated the exchange of much technical information.

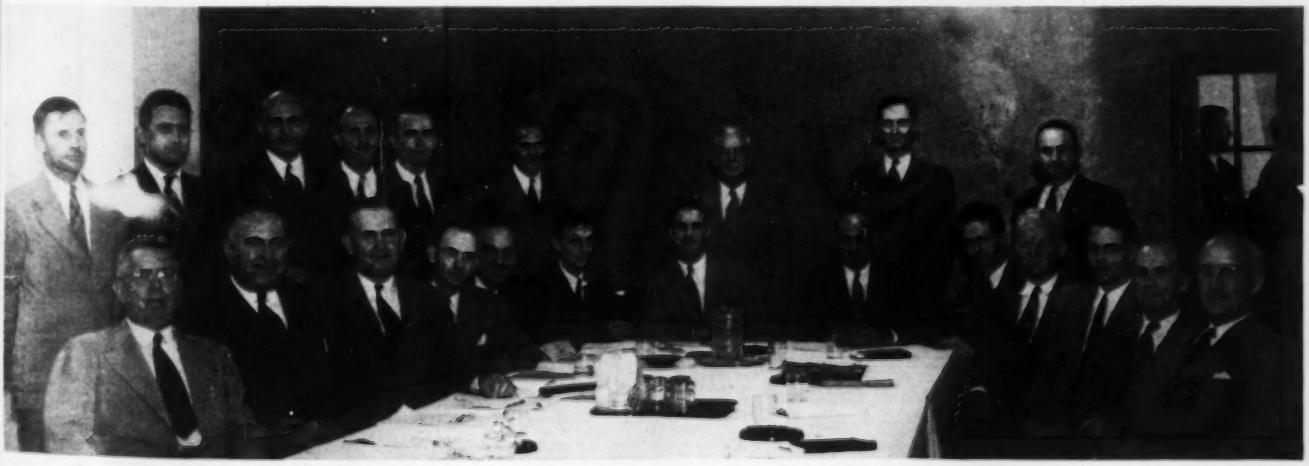
EJC Account Presented

The accomplishments of EJC were reviewed by Malcolm Pirnie, a member of the Council and ASCE Past-President (see page 18). Among activities cited by Mr. Pirnie, speaking at the Wednesday morning general session, were the survey of the engineering profession, results of which have just been published, and the fostering of engineers' interest in current science foundation legislation.

A cordial welcome was extended to the convention-goers at this Wednesday morning session by Harold D. Van Vranken, president of the ASCE Florida Section and by Commissioner P. M. Ulsch of Jacksonville. President E. M. Hastings responded in behalf of the visiting Society members.

HOSTESS COMMITTEE MEETS at luncheon to discuss details of entertainment for ladies attending ASCE Fall Meeting. Seated, left to right: Miss Crissy Simons, Mrs. Ralph Spalding, Mrs. Russell Redman, Mrs. George B. Hills, Sr., Mrs. J. B. Miller, Mrs. Richard Cloues, Mrs. A. H. Brown, and Mrs. Russell De Grove. Standing, in same order, are: Mrs. Gilbert Youngberg, Mrs. S. S. Jacobs, Mrs. Robert M. Angas, chairman of hostess committee, Mrs. Harold Scott, Mrs. H. D. Van Vranken, and Mrs. George W. Simons, Jr.

REPRESENTATIVES FROM 13 Sections in Southeast meet for two-day Local Section Conference in Jacksonville. Seated, left to right, are: Robert M. Angas, general chairman of Fall Meeting; Harold D. Van Vranken, president, Florida Section; J. F. Tribble, Alabama; J. N. Wallace, West Virginia; Perley A. Rice, Virginia; Scott B. Lilly, Philadelphia; Donald du Plantier, Nashville; Albert E. Johnson, South Carolina; R. W. Cloues, Florida; Van Porter Enloe, Georgia; Raymond W. Pierce, Georgia; S. M. Bailey, Kentucky; and ASCE Director Harland C. Woods, Buffalo, N. Y. Standing, left to right: John Telfair, Florida; Don P. Reynolds, Assistant to Secretary, New York City; Ernest M. Titus, Tennessee Valley; W. C. Gorman, Miami; William Randolph Chalker, Florida; Paul Hardaker, Florida; Garner W. Miller, Mid-South; John D. Watson, North Carolina; and Bernhard Dornblatt, Louisiana.



OVER 100 DELEGATES from 21 Student Chapters gather in Jacksonville for all-day Student Chapter Conference, on October 14. In front row (third from left) are Prof. C. D. Williams, Faculty Adviser for University of Florida Chapter, and (to his right, in usual order) Brooks Earnest, chairman of ASCE Committee on Student Chapters; Harrison D. Comins, assistant professor of civil engineering at University of Florida; and Tom Allardyce, president of host Student Chapter and chairman of Student Conference.

Banquets, Entertainment

Dinners and entertainment presented by the sponsoring Florida Section included a grand affair complete with banquet, dancing and entertainment on Wednesday evening, a bingo party with all the trimmings on Thursday evening, special luncheons on both Wednesday and Thursday (see page 18), and practically continuous entertainment of the women by an active group of Jacksonville wives headed by Mrs. Robert M. Angas.

Excursions Arranged

Friday, the last day of the meeting, was given over to the excursions. A large group traveled down the Florida east coast to Marineland to visit the famed Marine Studios. It was to be expected that some of the engineers expressed more interest in the pumping and water treating plant that furnishes the salt water for the enormous tanks than in the variety of marine life in the tanks. The all-day tour took the group through historic St. Augustine on the return trip to Jacksonville.

Another popular excursion took members and their guests to the University of Florida campus at Gainesville, where they inspected the new experimental sewage disposal plant now under construction.

Numerous informal inspections were scheduled through the week to points of interest in and around Jacksonville permitting those interested to take maximum advantage of the numerous points of interest in the vicinity.

Efforts of Arrangements Committee Recognized

The universal gratitude of those in attendance for the fine job done by the local arrangements committee must be noted. Robert M. Angas, general chairman, supplemented his energetic local group with representatives of other Sections in the area, resulting in marked enthusiasm and a large attendance.

Chapters and Sections Convene

With attention to new activities of ASCE Local Sections, delegates from 13 of the Sections in the Southeast met for a two-day conference in Jacksonville. These sessions, held previous to the general meeting, provided for the pooling of the ideas of Section officers.

Another and much larger conference was held by the Student Chapters in the area. Twenty-one Chapters sent over 100 students to the conference. Two men flew to the meeting from Iowa State College at Ames.

Broadcasts in Meeting Week

Five 15-minute radio programs were broadcast during the meeting week. Participants were ASCE President E. M. Hastings, Vice-President Gail A. Hathaway, Past-Presidents W. W. Horner and J. C. Stevens, Executive Secretary William N. Carey, and Charles M. Upham, chairman of the Highway Division's executive committee. In these broadcasts listeners were informed of the progress of the Fall Meeting in Jacksonville and were told of the role played by civil engineers in war and peace.

TWO STUDENTS FROM Iowa State College—Ellis B. Pickett (left) and Lawrence Sieck—reach Student Conference at Jacksonville by air, flying latter's plane from Ames, Iowa.

Members Appointed to Building Research Board

WITH THE APPOINTMENT of 22 engineers, scientists, architects, contractors and others interested in building construction research as members, the Building Research Advisory Board gets actively under way. The aims and organization of the new Board have been explained in detail in CIVIL ENGINEERING by two authors: J. C. Stevens, Past-President ASCE, chairman of the U.S. Chamber of Commerce Construction Industry Advisory Council (August 1947 issue, page 36); and R. H. Tatlow III, M. ASCE, president of Abbott, Merkt & Co., New York (November 1947 issue, page 44).

It is planned that the Building Research Advisory Board will do for the building field what the Highway Research Board (also an activity of the National Research Council) has accomplished so successfully for the highway field. In general, its aims are improved efficiency in the building industry and correlation of research. Support of the Board for a five-year trial period is assured through action of the U.S. Chamber of Commerce. Efforts are now being made to bring the aims of the Board before the national engineering and contracting bodies that will benefit most from its work.

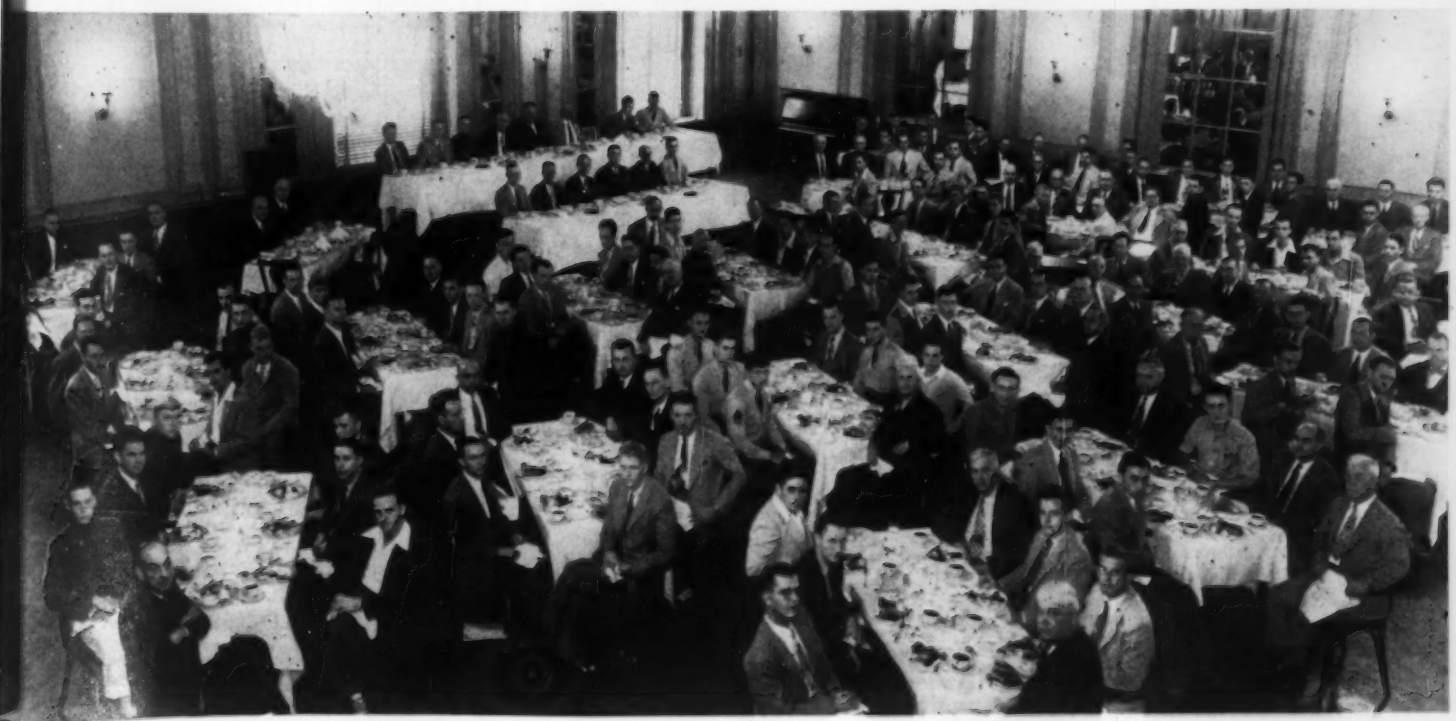
ASCE MEMBERS FROM all parts of country (above) attend opening session of Fall Meeting of Society in Hotel Roosevelt, Jacksonville, Fla., October 15. Total meeting attendance numbered more than 500.

HAROLD D. VAN VRANKEN, president of host Section (left), discusses program of Jacksonville Meeting with ASCE President E. M. Hastings (center) and Executive Secretary William N. Carey (right).

FALL MEETING OF Society is called to order (above) on October 15 by Harold D. Van Vranken, president of Florida Section. Left to right: Past-President J. C. Stevens; P. M. Ulsch, Jacksonville city commissioner, who welcomed group to city; Past-President Malcolm Pirnie, who delivered principal address of morning session; President E. M. Hastings; Mr. Van Vranken; and Past-President W. W. Horner.

COMMITTEE OF LOCAL members, which capably handled arrangements for Fall Meeting of Society in Jacksonville, October 15–17, is pictured above. Shown, in usual order, are: William G. Buecheler, Harold Scott, John F. Reynolds, Russell De Grove, Robert M. Angas, general chairman of meeting, Prof. C. D. Williams, Florida Section President Harold D. Van Vranken, and Richard Cloues.

DELEGATES TO LOCAL SECTION and Student Chapter Conferences—held in Jacksonville, Fla., October 13 and 14, in conjunction with ASCE Fall Meeting—enjoy large joint luncheon (below) with members of Board of Direction on October 14.



Dues Increase Rejected by Narrow Margin as Juniors Are Enfranchised

ENFRANCHISEMENT OF JUNIORS was accepted and an increase in ASCE dues rejected in the October 7 ballot on two proposed Amendments to the Society's Constitution.

Some 14,800 Corporate Members, the only ones then eligible to vote, received ballots on which to register their views on the proposed Amendments. The 6,888 who voted on the Dues Amendment (44 more than the ballots cast on the Enfranchisement-of-Juniors Amendment), therefore, represent 46.5 percent of the eligible voters. The 4,517 who favored the dues increase constitute 30.5 percent of the eligible voters, and the 2,371 who registered opposition to the increase, 16 percent. Not voting were 53.5 percent of those eligible.

As counted by a committee of tellers at a meeting in Society Headquarters at 8 p.m., October 7, the detailed vote is as shown in the tabulation which appears below.

A two-thirds majority of votes cast being necessary for approval of any proposed Constitutional Amendment, the totals were as follows:

Enfranchisement of Juniors

For the Amendment	Against the Amendment	Required for Adoption	Approved by Margin of
5,370	1,474	4,563	807 votes

Increasing Society Dues

For the Amendment	Against the Amendment	Required for Adoption	Disapproved by Margin of
4,517	2,371	4,592	75 votes

DETAILED VOTE, BY STATES, ON TWO AMENDMENTS TO SOCIETY'S CONSTITUTION

States	Voters Eligible	Dues Amendment: Votes Cast	Yes	No	Margin For	Margin Against	Juniors Amendment: Votes Cast	Yes	No	Margin For	Margin Against
Alabama	152	79	56	23	3.3	...	79	69	10	16.3	...
Arizona	105	56	36	20	...	1.3	56	45	11	7.7	...
Arkansas	86	45	26	19	...	4.0	44	32	12	2.7	...
California	2,021	1,034	692	342	2.7	...	1,032	803	229	115.0	...
Colorado	240	135	83	52	...	7.0	132	107	25	19.0	...
Connecticut	210	77	40	37	...	11.3	77	67	10	15.7	...
Delaware	54	38	18	20	...	7.3	36	20	16	...	4.0
District of Columbia	474	297	187	110	...	11.0	294	242	52	46.0	...
Florida	231	100	60	40	...	6.7	99	67	32	1.0	...
Georgia	185	78	45	33	...	7.0	77	59	18	7.7	...
Idaho	46	30	16	14	...	4.0	29	26	3	6.7	...
Illinois	669	318	200	118	...	12.0	316	237	79	26.3	...
Indiana	147	83	54	29	...	1.3	84	69	15	13.0	...
Iowa	130	66	47	19	3.0	...	65	54	11	10.7	...
Kansas	135	60	33	27	...	7.0	59	45	14	5.7	...
Kentucky	94	53	37	16	1.7	...	52	39	13	4.3	...
Louisiana	187	75	57	18	7.0	...	73	59	14	10.3	...
Maine	45‡	62‡	44	18	2.7	...	59‡	42	17	2.7	...
Maryland	394	110	72	38	...	1.3	108	84	24	12.0	...
Massachusetts	426	178	124	54	5.3	...	176	138	38	20.7	...
Michigan	356	151	95	56	...	5.7	148	110	38	11.3	...
Minnesota	150	85	70	15	13.3	...	85	76	9	19.3	...
Mississippi	74	50	37	13	3.7	...	50	42	8	8.7	...
Missouri	421	220	145	75	...	1.7	220	177	43	30.3	...
Montana	55	36	23	13	...	1.0	36	29	7	5.0	...
Nebraska	125	51	28	23	...	6.0	52	39	13	4.3	...
Nevada	21	16	12	4	1.3	...	15	11	4	1.0	...
New Hampshire	30	11	7	4	...	0.3	11	8	3	0.7	...
New Jersey	483	163	94	69	...	14.7	163	121	42	12.3	...
New Mexico	63	39	29	10	3.0	...	39	33	6	7.0	...
New York	1,960	862	570	292	...	4.7	862	687	175	112.3	...
North Carolina	119	52	34	18	...	0.7	53	39	14	3.7	...
North Dakota	26	16	12	4	1.3	...	16	13	3	2.3	...
Ohio	564	281	201	80	13.7	...	283	233	50	44.3	...
Oklahoma	109	69	45	24	...	1.0	70	55	15	8.3	...
Oregon	210	119	78	41	...	1.3	120	94	26	14.0	...
Pennsylvania	873	370	240	130	...	6.7	368	287	81	41.7	...
Rhode Island	55	19	11	8	...	1.7	18	12	6	0.0	0.0
South Carolina	78	28	25	3	6.3	...	28	21	7	2.3	...
South Dakota	18	14	9	5	...	0.3	14	10	4	0.7	...
Tennessee	310	188	67	121	...	58.3	187	132	55	7.3	...
Texas	681	348	232	116	0.0	0.0	341	261	80	33.7	...
Utah	71	36	21	15	...	3.0	36	33	3	9.0	...
Vermont	18	5	4	1	0.7	...	5	3	2	...	0.3
Virginia	325	139	93	46	0.3	...	139	104	35	11.3	...
Washington	349	172	125	47	10.3	...	169	141	28	28.3	...
West Virginia	95	51	31	20	...	3.0	50	41	9	7.7	...
Wisconsin	150	87	61	26	3.0	...	86	66	20	8.7	...
Wyoming	23	13	10	3	1.3	...	14	12	2	2.7	...
Canada	97	40	29	11	2.3	...	40	32	8	5.3	...
Canal Zone	60	33	28	5	6.0	...	34	25	9	2.3	...
Hawaii	54	20	17	3	3.7	...	19	18	1	5.3	...
Puerto Rico	62	17	12	5	0.7	...	17	13	4	1.7	...
Foreign	728	113	95	18	19.7	...	109	88	21	15.3	...
Totals	14,844	6,888	4,517	2,371	116.3*	191.3*	6,844	5,370	1,474	811.6†	4.3†

* Net 75 votes against.
† Net 807.3 votes for.
‡ State classification of ballots was by postmarks.

Budget Balanced by Drastic Curtailment of Society Expenditures

LOYALTY FUND ESTABLISHED FOR VOLUNTARY CONTRIBUTIONS

A BALANCED BUDGET for the current fiscal year, in which Society expenditures will be limited to anticipated receipts, was adopted by the ASCE Board of Direction at its Fall Meeting in Jacksonville, Fla., October 13–14. This balanced budget, which anticipates expenditures of $710,688, is in sharp contrast with last year's budget which was adopted with a $56,000 expected deficit. Actually, during the fiscal year ending September 30, 1947, a deficit of $47,573 was incurred, and the Society depleted its limited reserves to that extent.

Both the new and last year's budgets were adopted by the Board with the proposed increase in Society dues in mind. Last year the Board intentionally directed operations on a deficit basis, with the hope that a dues increase would permit restoration of most of the funds required to meet present inflationary costs. The recent defeat of the proposed constitutional amendment to increase dues gave the Board an immediate directive to curtail expenses drastically this year from what it considered normal for the Society. Some of the major reductions the Board was forced to make are:

The scheduled appropriation for Local Sections, in the amount of $45,642, was reduced by $19,250 to $26,392. This reduction is effected principally through a revision in the Local Sections allotment formula. Under the old formula, $31,000 would have been returned to the Local Sections. The return, under the new formula, amounts to $14,000. A further reduction of $2,250 in the scheduled Local Sections appropriation will result from a ruling of the Board that the Society can pay from general funds but one-half of the present mileage allowance to local delegates attending Local Section conferences.

PROCEEDINGS and Memoirs, with a normal budget of $79,912, will be limited to expenditures of $69,912, a reduction of $10,000. Publication of manuals estimated to cost $26,672, was deferred for the year.

One-sixth of its normal $18,000 appropriation for travel to and from the quarterly meetings of the Board was eliminated, thus saving the Society an additional $3,000. This saving, equivalent to a personal contribution of about $125 per year by each Board member, was the result of the Board's strong feeling that the Society's financial situation today demands every practicable economy and sacrifice.

Hope for, as well as need of, additional Society income occupied the major interest of the Board at this meeting. Confidence was expressed that the membership of the Society, once the situation is understood, will take the necessary steps to provide adequate income for a return to normal operations and activities. Even though a new constitutional amendment for a dues increase might be considered and approved this year—a possibility now under consideration in some Local Sections—constitutional procedures would not assure receipt of dues income in time to affect this year's budget. The Board, therefore, adopted the expedient of appealing to the membership for personal contributions to a "Loyalty Fund."

The Loyalty Fund is established as a result of the adoption of the following resolution:

"BE IT RESOLVED That the Board of Direction of the American Society of Civil Engineers hereby authorizes the creation of a Loyalty Fund to which every member of the Society, including Members, Associate Members, Juniors, Life Members, Honorary Members, Affiliates and Fellows be given an opportunity to make a voluntary contribution.

"BE IT FURTHER RESOLVED (1) That, upon billing the annual dues of dues-paying members, space be provided on each bill for listing such voluntary contribution and that an adequate explanation thereof be mailed with the bill, and (2) that a card containing space for listing such voluntary contribution and an adequate explanation thereof shall be mailed to each non-dues-paying member of the Society (Honorary Members and Life Members).

"BE IT FURTHER RESOLVED That the money received from such voluntary contributions be credited to a special fund designated "Loyalty Fund," and withdrawals therefrom shall be made only on authorization of the Board of Direction."

While in session at Jacksonville the Board received letters from two Local Section groups requesting that the Board initiate new petitions for a dues increase, but it was decided that such petitions should originate in the Local Sections. The Constitution provides for origination of such petitions by Sections, Districts and Zones.

One of the letters received was from the Junior Branch, Metropolitan Section, in New York. After expressing to the Board the gratification of the Branch in the successful outcome of the balloting to enfranchise Juniors, the letter stated:

"The members further express the hope that the proposal of an increase in dues of the Society members, defeated in the last referendum, be opened again at the discretion of the Board of Direction, in order that Juniors may participate in the decision that affects all Juniors as well as all Corporate Members."

The other letter was from the Tennessee Valley Section in which the Board was advised that the Section's Directors have authorized their President and Secretary-Treasurer,

"To request the Board of Direction at the Jacksonville Meeting to authorize the circulation of a petition to amend the Constitution by increasing membership dues for all Corporate Members by $5.00 per year, and for all Juniors by $2.50 per year, in accordance with the wording of the original petition.

"We believe," the letter continued, "that such an amendment, standing on its own merits and clearly expressed as stated above, will find favor in the eyes of the required majority of the Society's membership including the newly enfranchised Juniors. We furthermore will give our unqualified support to such legislation that will foster the welfare and future growth and progress of ASCE."

For the year ahead, the Board at Jacksonville has directed that Society activities be maintained at the best level practicable within the limits of a drastically curtailed but balanced budget and the expected contributions to the newly authorized Loyalty Fund.

National Conference Backs Water Policy Study Proposed by ASCE

PROGRESS ON the ASCE proposal for substitution of a national water policy for present "piecemeal development of water programs," to eliminate jurisdictional conflicts and confusion and to insure maximum benefit from "this element of wealth which is as much a national resource as the country's minerals," was reported to the Society's Board of Direction at its Fall Meeting in Jacksonville.

The report was made by Dean Thorndike Saville of New York University's School of Engineering, a member of the Board, who told the Board:

"Our Society's recommendation for a nationwide survey of the country's water resources, made by action of this Board at our meeting in Phoenix, Ariz., last April, was endorsed and made the subject of Resolution No. 1 adopted by the National Water Conservation Conference in Kansas City, Mo., last month."

Dean Saville attended the Kansas City meeting as a member of the Society committee assigned to plan ways and means of effectuating the Society's recommendation of last April. Past-President W. W. Horner, St. Louis, also attended the Kansas City meeting as chairman of an Engineers Joint Council committee to which was referred the Society's recommendation (CIVIL ENGINEERING for May 1947, page 49; July 1947, page 52) that the entire engineering profession, through EJC, press for an exploration of procedures necessary for establishment of a national water policy. Other members of the ASCE committee on which Dean Saville is serving are Carlton Proctor, New York City, and R. J. Tipton, Denver, Colo.

"The National Water Conservation Conference," Dean Saville told the Board, "made up of state officials and representatives of various organizations throughout the United States interested in water conservation, adopted as its primary resolution one which asserts, as our Society's recommendation stated, 'the situation requires that steps should be taken to explore the various facets of land and water use and control, including the extent of the undeveloped water resources of the nation; the existing federal, state and local laws and agencies charged with the development and control of water; the conflicts of jurisdiction, planning and execution existing among or between these laws and agencies; the effect upon the national economy, welfare and safety of existing laws, and the policies and activities of the agencies concerned; and the relation of these factors to other elements of the national economy such as industry, agriculture and commerce.'"

The resolution also pointed out, Dean Saville said, that "the program of land and water conservation, development and utilization in the nation is conducted under laws and policies adopted at various times in the past, and hence not adequately interrelated or adapted to an over-all concept of land and water use and control."

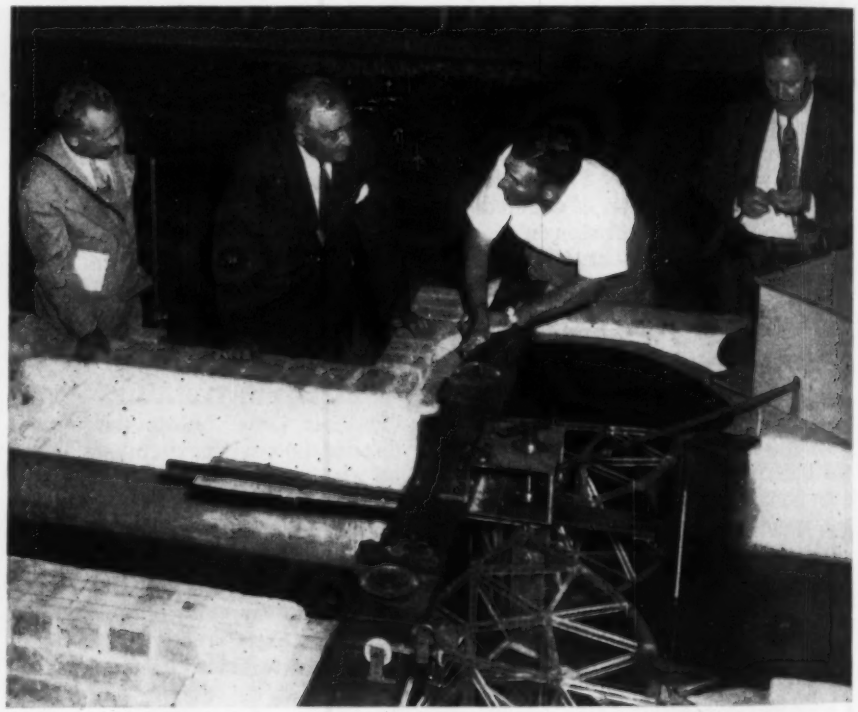
Copies of the resolution, Dean Saville said, were forwarded to President Truman, the President of the Senate, the Speaker of the House of Representatives and to the governors of the 48 states "in order that they may be informed of the desire for establishment of a commission to study this all-important matter."

Supplementing his report to the Board, Dean Saville said:

"Discussion has been under way for years, with opinions plentiful on both sides of the federal-versus-states'-rights controversy. Advocates of states' rights call valley authorities 'undemocratic and paternalistic,' and point out that federal projects are planned by agencies with continuing interest in the developments. On the other hand, those favoring federal control of water programs point to the flood-free Tennessee Valley Authority project as a benefit to the affected area, only to have opponents come back with a demand for a more business-like accounting of expenditures there.

"The point is that there is no point merely in continuing the discussion. For while the arguments rage, confusion continues to pile upon confusion. What is needed is a broad study leading to establishment of a national policy, with clearly defined positions for all subdivisions of government in a cooperative effort between the various states and the federal government; with the public completely protected and assured of economic planning and construction of water projects by unbiased reviews by engineers who have no continuing interest in such developments.

"It is the hope of the engineering profession that the preliminary work of our temporary committee will lead to the undertaking of such a broad water study for relating all the pertinent factors to all elements of the national economy, such as industry, agriculture and commerce."



MEMBERS OF ASCE Hydraulic Research Committee, meeting in Vicksburg, Miss., September 22–23, inspect sector gates on Algiers, La., lock model at Waterways Experiment Station, Vicksburg. Pictured here, in usual order, are George H. Hickox, head of Tennessee Valley Authority Hydraulic Laboratory; Boris A. Bakhmeteff, Hon. M. ASCE, chairman of ASCE Committee on Hydraulic Research and professor of civil engineering at Columbia University; Thomas E. Murphy, chief, Structures Section, Waterways Experiment Station; and Jacob E. Warnock, head of Bureau of Reclamation Hydraulic Laboratory. Also present at meeting but not shown in photograph was committee member Joseph B. Tiffany, Jr., technical executive assistant, Waterways Experiment Station.

Annual Prizes for Basic Research Projects Offered by ASCE Committee

$500 in Research Prizes

FIVE PRIZES, in the amount of $100 each, have been authorized for award annually by the Society's Committee on Research. The objective is the stimulation of carefully conceived projects of fundamental research in civil engineering. The prizes will be awarded for the best suggestions for research projects submitted by a member of the Society and approved by one of the Technical Divisions of the Society as suitable for sponsoring by the Committee on Research. It should be pointed out that these awards are for proposed projects in "basic" research as contrasted with what may be termed "testing" research.

The committee is of the opinion that while industry and public agencies have fairly liberally provided facilities for conducting the testing type of research, there are large opportunities, hitherto insufficiently explored, for the application of engineering knowledge to fundamental problems requiring basic research.

By basic research is meant in general the application of fundamental scientific and engineering knowledge to the discovery of new or improved procedures, techniques, inventions, practices, methods, or materials used in engineering.

Rules for Awards

To govern award of the prizes, the following rules have been established:

A. Research projects submitted for the prizes shall be submitted initially to the Executive Committee of an appropriate Technical Division of the Society. The Executive Committee of any Division may transmit to the Committee on Research not more than three projects in any one year which it desires to endorse as meeting the above specifications for basic research.

B. The Committee on Research shall consider research projects approved by any Division Executive Committee. It may award a prize of $100 to the author of the best project coming from any Division. Not more than one prize each year shall be awarded through a given Division, and there is no obligation of the Committee on Research to award any prize unless a project is, in its judgment, worthy of such award.

The maximum number of prizes to be awarded annually shall not exceed five.

C. In considering projects for award, the Research Committee will be guided by the following criteria:

1. The project shall be of a fundamental character.
2. The need and objectives of the research shall be fully set forth.
3. The project shall be fully outlined, indicating objectives to be sought, methods to be followed, staff and equipment required, and a rough estimate of the cost and the time for completion.

Committee to Assist Financing

The Committee on Research is organized to assist in securing financial support to undertake fundamental research of value to the civil engineering profession. Thus, if a project is approved by any one of the Technical Divisions, there is a good chance that in addition to the $100 award the author of the program will have the satisfaction of seeing his program financed and the actual research work undertaken. The Committee on Research is of the opinion that extremely significant contributions to the advancement of the Profession of civil engineering may be consummated by the suggestions for research projects which it hopes will be stimulated by these prizes.

Society Publications Cover Entire Range of Civil Engineering Subjects

REQUIREMENTS GOVERNING the acceptance of papers permit the Society publications, CIVIL ENGINEERING and PROCEEDINGS, to cover the entire range of subjects in the field of civil engineering. The two publications coordinate to publish papers that vary from highly technical treatises on scientific subjects to short, timely expositions on current developments of wide general interest to Society members.

Usually, proper allocation of a given paper is obvious to the editors of CIVIL ENGINEERING and PROCEEDINGS upon examination of the subject matter on the basis of technical content, length, illustrations, timeliness and treatment. Thus, papers submitted to one publication may be referred to the other for review, but their acceptance by either publication is based on their ability to meet definite prescribed standards—not on their intrinsic worth to a particular technical field or to the profession as a whole.

Occasionally, for example, an excellent paper that has an important current timeliness may be declined for PROCEEDINGS because it is judged to be unsuited to discussion. It may be declarative, instructive and in large measure conclusive. Such a paper, declined for PROCEEDINGS, may well be used to advantage in CIVIL ENGINEERING or possibly as the basis for a manual of engineering practice. Referral to CIVIL ENGINEERING does not imply that it is inferior in any sense but simply that the story fits that publication better than the PROCEEDINGS. The reverse is likewise true—that often a paper reviewed for CIVIL ENGINEERING is finally classified as a PROCEEDINGS paper. The Committee on Publications is charged with the responsibility for the content of both publications; separate staffs handle the details of each, but there is an excellent spirit of cooperation toward presenting papers in the best form for use by the profession.

Most members of the Society are aware of the difference in the type of material published in CIVIL ENGINEERING and PROCEEDINGS, but many are not familiar with the rules and regulations that establish the dividing line. CIVIL ENGINEERING articles are chosen for timeliness of subjects and their general interest to readers in the various branches of civil engineering as defined by the Society's 13 Technical Divisions. They are brief, well-illustrated expositions devoid of highly technical material that would necessarily limit their appeal to a few experts in a particular branch of the profession. Special departments in CIVIL ENGINEERING provide flexibility in coverage of professional news and permit the presentation of many services to Society members.

Ruling requirements for PROCEEDINGS papers on the other hand are originality, long-term value, fundamental novelty, and the necessity for widespread technical discussion. The ideal paper for PROCEEDINGS is a concise technical exposition of a new principle, research, theory, operation or application, that requires open discussion for verification or disproval. The principle of objective thesis, constructive criticism and author's closure or rebuttal is fundamental to PROCEEDINGS. From this tested procedure come technical developments in the field of civil engineering that can be accepted and applied with confidence.

Strict, high standards necessarily cause a high mortality in the many manuscripts submitted for publication in PROCEEDINGS, but the screening process makes that publication the accepted medium for the development and exchange of scientific and technical knowledge in its field. When collated each year

to form TRANSACTIONS, these papers and their discussions become the permanent record of contemporary development of the science of civil engineering.

Thus the two publications are coordinated, essential parts of our integrated publication program. They are different obviously, but just as obviously serve to supplement each other in reporting and recording the scientific, technical and noteworthy developments in civil engineering. Both CIVIL ENGINEERING and PROCEEDINGS perform distinctive and important functions in the Society's service to its membership.

HARRY F. THOMSON, *Chairman*
Committee on Publications

ASCE Represented in Plans for International Conferences in Europe

SOCIETY REPRESENTATION at the Third International Conference on Large Dams, World Power Conference, is assured by Vice-President Gail A. Hathaway's acceptance of an appointment to serve on the proposed advisory group for the U.S. Committee on Large Dams. Mr. Hathaway, special assistant to the Chief of Engineers, Washington, D.C., is also a member of the Corps of Engineers' committee to select delegates and authors for the 1948 international conferences in Europe. The appointment was made by E. M. Hastings who, because of his office as president of ASCE, is an ex-officio member of the Executive Committee of the U.S. National Committee, World Power Conference.

Gano Dunn, M. ASCE, president of the J. G. White Engineering Corp., New York, N.Y., is chairman of the Executive Committee, U.S. National Committee, World Power Conference. Michael W. Strauss, Commissioner, Bureau of Reclamation, is chairman of the American National Committee of the International Committee on Large Dams (Comm. Internationale des Grands Barrages), which consists of the following members:

Frank A. Banks, Assoc. M. ASCE, supervising engineer, Bureau of Reclamation

Carl P. Vetter, M. ASCE, chief, Office of River Control, Bureau of Reclamation

John L. Savage, Hon. M. ASCE, consulting engineer, Denver, Colo. (formerly chief design engineer, Bureau of Reclamation)

Samuel B. Morris, M. ASCE, general manager and chief engineer, Department of Water and Power, City of Los Angeles

Another ASCE member, Dr. Lorenz G. Straub, director of the St. Anthony Falls Hydraulic Laboratory, is the official contact man of the International Association for Hydraulic Structures Research in the United States, an organization entirely separate and distinct from the World Power Conference.

According to the latest information available, the following are the dates for the international conferences now scheduled:

The International Association for Hydraulic Structures Research, Stockholm, Sweden . . . June 7–9, 1948

The International Commission on Large Dams, Stockholm, Sweden . . . . . June 10–17, 1948

The Second International Conference on Soil Mechanics and Foundations, Rotterdam, Holland . . . . . June 21–30, 1948

Washington Registration Board Is Appointed

GOVERNOR M. C. Wallgren of the State of Washington has appointed four of the members of the new five-man State Board of Registration for Professional Engineers and Land Surveyors provided for in the Professional Engineers Registration Act of 1947. The four members appointed are E. B. Crane, J. P. Hart, M. K. Snyder and R. G. Tyler, all Members of ASCE. Messrs. Crane, Hart and Snyder, members of the original board established in 1935, were reappointed for terms of two, one, and three years, respectively. Professor Tyler, who teaches sanitary engineering at the University of Washington, is the new appointee.

Edward C. Dohm, M. ASCE, who has been a member of the old board since its inception, was recently appointed as full-time executive secretary of the new board. This position was created to handle the details of the Board's work and to administer the act for the State Department of Licenses. This action will assure both the public and the profession that the new act for the registration of professional engineers, engineers in training and land surveyors will be policed. Harry C. Huse is state director of licenses.

The old law (1935), which is now superseded by the Act of 1947, provided for the registration of professional engineers in civil, electrical, mechanical, structural and hydraulic engineering and land surveying. Such of these as already hold certificates of registration under the old act (1935), about 1,500 professional engineers and land surveyors, are automatically registered under the 1947 Act without further payment of fees.

Other unregistered professional engineers in any branch of the profession must register under the 1947 Act in order to practice or offer to practice in any branch of the profession of engineering or land surveying. Until January 1, 1948, resident practicing engineers except civil, electrical, mechanical, structural and hydraulic engineers, and land surveyors, are eligible for registration without examination when their application is accompanied by affidavits of two professional engineers registered in the state.

For registration as a professional engineer an applicant must have had 8 years of satisfactory engineering experience; and must successfully pass an oral or written examination. Each applicant who passes the required examination receives a professional engineer certificate on which is stated the branch or branches of engineering in which he specializes.

An applicant for a license may take the required written examination in two stages: the first in the fundamentals of engineering subjects at any time after he has completed 4 of the required 8 years of experience; and the second, to test the applicant's ability to apply his knowledge and experience to his specific field of engineering, at any time after he has completed 8 years of experience. When an applicant passes the first stage of the examination he receives a certificate as an engineer-in-training.

Land surveyors with 6 years of satisfactory surveying experience, and who pass the required examination, receive a certificate as land surveyor.

Undergraduate work in a recognized engineering college may be considered as the equivalent of required experience, year for year up to 4 years. The Board may credit one additional year of post-graduate study toward required experience.

Violators of the provisions of the act are guilty of a misdemeanor. The Board must hear charges of violation promptly, and it has the exclusive power to revoke certificates of persons found guilty. Board action in denying or revoking a certificate may be appealed to a superior county court. The attorney general of the state is designated as the legal adviser of the Board in carrying out the provisions of the act; and all state officers and officers of politicial subdivisions of the state are charged with the duty of enforcing the new act.

WALTER E. JESSUP
ASCE Western Representative

NOTES FROM THE *Capital*

E. LAWRENCE CHANDLER, M. ASCE
Eastern Representative, ASCE

IN THE ABSENCE OF CONGRESS, most activity in Washington proceeds at a less hectic pace. Numerous Congressional committees are conducting hearings of various sorts but only a few of them carry any implications of special import to the engineering profession. Both the joint committee headed by Congressman Gamble and Congressman Gwinn's House Committee, each of which is exploring phases of the construction industry, are going forward. It is much to be hoped that engineers and others throughout the country who are in a position to be of assistance will grasp the opportunity to offer their services, not only to assist in abolishing undesirable practices, but also to emphasize constructive and forward-looking steps being undertaken by the industry. The Society was represented by Past-President Ezra B. Whitman and Harry M. Brown, M. ASCE, and by E. Lawrence Chandler, Eastern Representative, at early sessions of the Gamble Committee in Washington, D.C.

BUILDING RESEARCH ADVISORY BOARD

CIVIL ENGINEERING has carried stories of the newly created Building Research Advisory Board (see article by R. H. Tatlow III, M. ASCE, in this issue, page 44) which will function under the auspices of the National Research Council. It is gratifying to report that this promising undertaking is progressing soundly and well. The initial meeting of the Board, under the chairmanship of Dr. Frank B. Jewett, is tentatively scheduled for November 5 and a campaign is under way to secure from private industry the necessary funds to guarantee operations for a five-year period.

LICENSING OF ENGINEERS

One piece of prospective legislation is of specific interest to engineers. The District of Columbia now is the only spot in the country not covered by a law requiring licensing of professional engineers. The District is subject to the control of Congress and a licensing law must follow the regular course of any national legislation. Bills have been introduced in previous Congresses but, owing to lack of unified support by engineering groups, have failed of enactment. During recent months a new bill has been prepared by representatives of 13 of the societies represented on the District of Columbia Council of Engineering and Architectural Societies. This is now in the hands of the District's Commissioners for final polishing and approval and it is hoped that it will be presented in the next session of the current Congress. It is high time.

Water, Sewage Rate Structures Need Study, ASCE Director Tells American Bar Group

AN AUTHORITATIVE STUDY of rate schedules in connection with revenue financing of water supply and sewage disposal projects, with special emphasis on enabling acts and other governmental provisions "which often largely direct or restrict" their formulation, was advocated by ASCE Director Samuel A. Greeley, Chicago, in a recent address before the Municipal Law Section of the American Bar Association.

"Many present-day rate schedules for water supply and sewage disposal projects lack order," Mr. Greeley, of the engineering firm of Greeley and Hansen, told the attorneys. "The fundamental considerations are nowhere clearly stated, nor are they generally fully appreciated. The wording of enabling acts and other governmental provisions which often largely direct or restrict the formulation of rate structures is a highly important consideration."

Calling the need for a competent review urgent, Mr. Greeley ascribed the following as reasons for that view:

"In the next few years, many new sewage disposal projects will be financed by revenue bonds. There is a present tendency to set up rates for the operation and extension of existing sewage disposal projects and thus to bring these under revenue financing. There is need in many cases to increase revenues for both water supply and sewage disposal projects, requiring a change in the rate structure. There is a tendency to use water rates as a pattern for sewage rates, or to combine the two revenues in one rate structure."

Mr. Greeley cited views expressed by engineers and others on the inconsistencies and lack of fairness in many rates and rate structures, one of which called "the average water rate structure a queer hodgepodge, often representing merely the handiwork of local politicians, rather than the logic of engineering analysis."

In his conclusions, Mr. Greeley summarized some of the considerations illustrating the need for the suggested study in the following question form:

"Is the construction and operation of a water or sewage utility by a municipality a proprietary or a governmental function?

"Is the construction and operation of a water or sewage utility by private owners a proprietary or a governmental function?

"In a water or sewage utility, does its operation furnish a service or a commodity, or both?"

Capacity for future occupancy, fire protection, and maintenance and protection of public health should be taken into consideration in the study, Mr. Greeley said, to determine whether such services are furnished in addition to use. Another question that should be answered, he said, if the operation provides several kinds of services as well as use, is: Should the rates provide compensation for each kind of service?

"In such a study, consideration should be given to the origins of rate structures in private enterprise by venture capital and to the substantial number of municipal enterprises which have been financed in whole or in part by general obligation bonds supported by a tax on property," he asserted. "While new financing by revenue bonds seems likely to be greater for sewage than for water works, nevertheless water rates are pertinent because of their long and wide use."

ASCE Prizes and Awards Are Announced by Board

ASCE PRIZES AND awards for 1947 were announced by the Board of Direction at the Jacksonville meeting. Presentation to the following recipients will be made at ceremonies held during the Annual Meeting in New York in January. Further details, together with brief biographies of the recipients, will appear in the January 1948 issue of CIVIL ENGINEERING.

Norman Medal

BORIS A. BAKHMETEFF, Hon. M. ASCE, and WILLIAM ALLAN, M. ASCE, for Paper 2288, "The Mechanism of Energy Loss in Fluid Friction."

J. James R. Croes Medal

THOMAS R. CAMP, M. ASCE, for Paper 2285, "Sedimentation and the Design of Settling Tanks."

Thomas Fitch Rowland Prize

R. F. BLANKS, M. ASCE, and H. S. MEISSNER, M. ASCE, for Paper 2283, "Deterioration of Concrete Dams Due to Alkali-Aggregate Reaction."

James Laurie Prize

ROSS M. RIEGEL, M. ASCE, for Paper 2291A, "Structural Features of Hydraulic Structures."

Collingwood Prize for Juniors

F. L. EHASZ, Jun. ASCE, for Paper 2287, "Structural Skew Plates."

Rudolph Hering Medal

A. L. GENTER, M. ASCE, for Paper 2280, "Computing Coagulant Requirements in Sludge Conditioning."

The J. C. Stevens Award

MAURICE L. ALBERTSON, Jun. ASCE, for his discussion of Paper 2266, "Evap-

oration from a Free Water Surface." This award is given for the most meritorious discussion in the field of hydraulics, published in Vol. 111 of TRANSACTIONS.

Karl Emil Hilgard Prize (awarded biennially)

A. A. KALINSKE, Assoc. M. ASCE, for Paper 2273, "Conversion of Kinetic to Potential Energy in Flow Expansions."

Tellers Report on Second Ballot for ASCE Officers

October 15, 1947

To the Secretary of the
American Society of Civil Engineers

The tellers appointed to canvass the Second Ballot for Official Nominees report as follows:

For Vice-President, Zone I:	
Charles Blaney Breed	650
Carlton Springer Proctor	795
Void	32
Total	1,477
For Vice-President, Zone IV:	
John Wilbur Cunningham	1,457
William Day Shannon	642
Void	6
Blank	6
Total	2,111
For Director, District 1:	
(Two to be elected)	
William McKenna Griffin	888
Edmund Astley Prentis	888
Void	0
Total*	1,776
For Director, District 4:	
Joel DeWitt Justin	325
Void	0
Total	325
For Director, District 11:	
Julian Hinds	443
Don Hull McCreery	268
Void	3
Total	714
For Director, District 14:	
Webster Lance Benham	217
Norman Robert Moore	213
Void	0
Total	430
For Director, District 15:	
C. Glenn Cappel	488
Void	2
Total	490

Ballots canvassed		6,435
Ballots withheld from canvass:		
Without signature	7	
Total withheld	7	7
Total number of ballots received		6,442

Respectfully submitted,
GEORGE T. GILMAN, *Chairman*
JAMES D. PARSONS, *Vice-Chairman*

William H. Dieck	George H. Harp
R. Edward Kuhn	Rudolph Evers
M. O. Elkow	Francis B. Forbes
J. A. Lenecek	Michael Edward Fio
Henry Goldfinger	Frederick W. Ockert
Harry Newman	*Tellers*

* Actual number of ballots received: 888.

NEWS OF LOCAL SECTIONS

Coming Events

Alabama—All-day meeting at the Whitley Hotel, Montgomery, Ala., November 21, at 9 a.m.

Cincinnati—Meeting at the Herman Schneider Foundation, Cincinnati, December 3, at 6 p.m.

Cleveland—Dinner meeting at the Cleveland Engineering Society, Cleveland, November 21, at 6:30 p.m. Meeting at 8 p.m.

Connecticut—Dinner meeting in the Egyptian Room of the Hotel Bond, Hartford, Conn., November 19, at 6:30 p.m.

District of Columbia—Annual meeting in the Cosmos Club Auditorium, Washington, D.C., November 11 at 8 p.m. Election of officers will be held.

Georgia—Luncheon meeting in the Robert E. Lee room at Davison's, Atlanta, Ga., November 4, at 12:30 p.m.

Indiana—Joint meeting with Kentucky Section at Spring Mill State Park, Mitchell, Ind., November 8 and 9. Registration at 4 p.m. Saturday.

Iowa—Annual meeting at the Hotel Fort Des Moines, Des Moines, November 20. Sessions at 3 and 6 p.m. ASCE Director D. L. Erickson will speak.

Kansas City—Dinner at the Kansas City Club, November 24, at 6:30 p.m. Program in the K. C. Power & Light Building, at 8:15 p.m.

Kentucky—Two-day joint meeting with Indiana Section (see above).

Maryland—Joint meeting with the Engineers Club of Baltimore in the Maryland Casualty Co. Auditorium, Baltimore, November 12, at 8:30 p.m. Meeting will be preceded by cocktails at 6 p.m. and dinner at 7 p.m., at the Engineers Club, Baltimore.

Metropolitan—Meeting in the Engineering Societies Building, New York, November 19, at 8 p.m.

Mid-South—Annual meeting at Jackson, Miss., December 5 and 6.

Northwestern—Dinner meeting at the University of Minnesota, Minneapolis, November 3, at 6:30 p.m. This will be a joint meeting with all the Twin City engineering societies to hear Lt. Gen. Raymond A. Wheeler, Chief of Engineers.

Philadelphia—Dinner meeting at the Engineers Club, Philadelphia, November 11, at 6 p.m. Program at 7:30 p.m.

Sacramento—Regular luncheon meetings at the Elks Club every Tuesday at noon.

Seattle—Dinner meeting at the Engineers Club, Seattle, November 26, at 6:15 p.m.

Tennessee Valley—Annual meeting of the Section at Johnson City, Tenn., November 7 and 8. Registration at John Sevier Hotel, Friday at 1 p.m. Trip to Watauga Dam on Saturday.

Texas—Luncheon meeting of the Dallas Branch at the Adolphus Hotel, Dallas, December 2, at 12:15 p.m.

Virginia—Meeting at the Hotel Roanoke, Roanoke, Va., November 19, at 2:30 p.m. Dinner meeting at 6:30 p.m. Joint meeting with Engineers Club of Hampton Roads at the Pythian Castle, Norfolk, November 25, at 8 p.m.

Scheduled ASCE Meetings

ANNUAL MEETING

New York, N.Y., January 21–23
(Board of Direction meets January 19–20)

SPRING MEETING

Pittsburgh, Pa., April 7–9
(Board of Direction meets April 5–6)

Recent Activities

CENTRAL ILLINOIS

OBLIGATION OF THE older members of the Society to give advice and assistance to younger engineers was stressed by ASCE President E. M. Hastings in a recent talk on the history and growth of the Society. Addressing a joint dinner meeting of the Section and the University of Illinois Student Chapter, Mr. Hastings

emphasized the fact that all plans for future development of the Society must take into account the needs of the younger members of the profession. Seated at the speakers' table were Dean M. L. Enger, of the University of Illinois; Associate Dean H. H. Jordan; Wilbur M. Wilson, former ASCE Director and research professor of structural engineering; H. A. Spafford, state sanitary engineer; Alex Van Pragg, Jr., Decatur consultant; James M. Keith, Student Chapter president; and George S. Salter, ASCE Mid-West Representative.

DAYTON

THE DESIRABLE range of air entrainment in cement varies from 3 to 6 percent, according to G. B. Alexander, chief chemist for the Southwestern Portland Cement Co., Osborn, Ohio. In a talk on "Air Entraining Cement," given at a luncheon meeting, Mr. Alexander stated that recent tests made in a number of northern states indicate that concretes using air entrainment retain their strength and consistency a great deal longer than other concretes, despite extreme cold weather. Two commercial preparations, Bensol Resin and Darex, are the usual agents employed in the manufacture of air entrained cement.

GEORGIA

RECENT ATTEMPTS to form an engineers' joint council in Atlanta were described by Robert Olin Harris at the September meeting. Mr. Harris was elected temporary chairman of a "steering committee" that will represent the Section in making plans for the formation of a permanent organization. Another special meeting on sanitary engineering was held at the Georgia School of Technology. Various aspects of the subject were discussed by Thomas M. Lowe, head of the civil engineering department at Alabama Polytechnic Institute; George E. Symons, editor of *Water and Sewage Works;* and Ralph E. Fuhrman, superintendent of the District of Columbia sewage treatment plant. Col. Blake Van Leer then described the current building program at Georgia Tech, and discussed the new short courses being given for water and sewage-treatment plant operators.

KANSAS

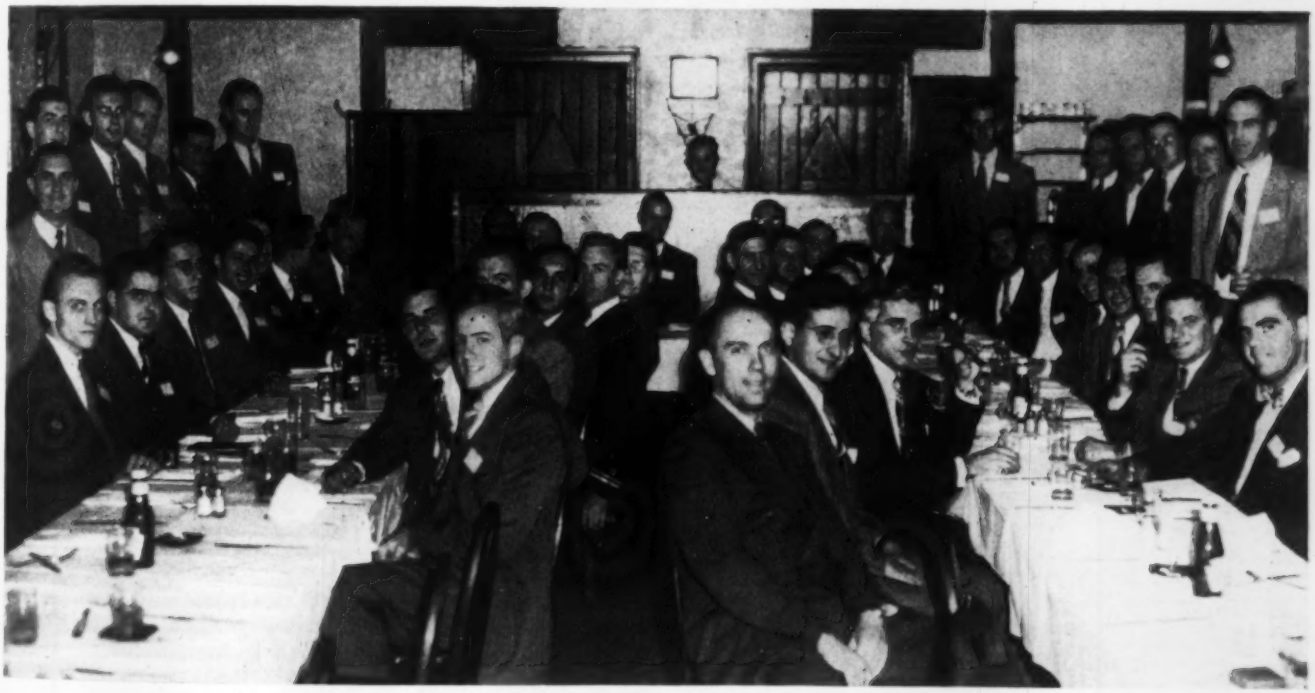
THOUGH KANSAS has the reputation of being a great tornado state, a study of the facts shows that such is not the case, S. D. Flora told members of the Section at their first meeting of the fall season. Mr. Flora, who has been chief of the Topeka office of the U.S. Weather Bureau for the past 40 years, is a specialist in the study of tornadoes and has a large file of pictures and slides of such storms. Many of the tornadoes that do reach Kansas blow themselves out on the plains without coming into contact with buildings, he stated. Mr. Flora also discussed the history of floods in the state and described the system used by the U.S. Weather Bureau in forecasting floods, pointing out how closely the information given correlates with the information needed by the civil engineers of the state.

LOUISIANA

ASCE DIRECTOR Oscar H. Koch attended a recent meeting and reviewed current activities of the Board of Direction. In particular, Mr. Koch stressed the value to the whole profession of EJC participation in world affairs, mentioning recent efforts to place engineers in proper administrative positions in the Department of the Interior. The proposed changes in ASCE membership grades were discussed by C. G. Cappel, who recommended that the Section study the matter and advise the Board of Direction as to its opinion on the subject. A talk on "Some Aspects of the Foundation Business"—given by Herbert D. Oliver, of Atlanta, Ga.—concluded the technical program. Mr. Oliver, who is Southern manager for the Raymond Concrete Pile Co., illustrated his talk with movies showing the driving of the Raymond cast-in-place and composite piles.

NEW MEXICO

WIRE ROPE IN engineering was the topic of technical discussion at a meeting held in Santa Fe. The principal speaker on the program was Fred D. Hartford



ENGINEERS MUST ASSERT their opinions in community and government affairs as well as in technical matters, Frederick Zurmuhlen, M. ASCE, told members of Junior Branch of Metropolitan Section at smoker and get-together on October 8. Emphasizing duty of engineers to society, speaker stated that profession can help advance civilization if it will broaden its interests and activities. Group of about 50 pictured here, heard Mr. Zurmuhlen and Allen Wagner, ASCE Public Relations Assistant to Secretary, who announced outcome of balloting on Junior enfranchisement and proposed increase in Society dues.

highway bridge engineer for the Public Roads Administration. Part of the meeting was devoted to discussion of plans for forthcoming meetings.

MONTANA

ACTIVITIES TO DATE of the Montana Board of Registration for Civil Engineers and Land Surveyors were summarized at a recent meeting by John H. Morrison, chairman of the Board. The other members of the Board, which was appointed in July, are Richard J. Hale, vice-chairman; E. R. Dodge, secretary; A. E. Adami and S. D. Waldorf. During the evening, Section President P. M. Johnson and Prof. E. R. Dodge, Faculty Adviser to the Student Chapter at Montana State College, discussed the proposed changes in ASCE membership grades.

NORTHWESTERN

DESIGN PROBLEMS encountered by the Bureau of Reclamation in the construction of dams in the Missouri River basin were described by W. H. Nalder, at the October 6 dinner meeting. Mr. Nalder, who is assistant chief designing engineer for the Bureau, also discussed design details of several of the Bureau's projected structures. Guests of the Section for the occasion included Julian Hinds, chief engineer for the Metropolitan Water District of Southern California, Los Angeles, and William G. Hoyt, executive officer of the Department of the Interior, Water Resources Committee, Washington, D.C.

PHILADELPHIA

TO PLAN MEETINGS especially for the Juniors and to encourage their participation in Section activities, the Philadelphia Section has organized a Junior Forum. An executive committee—made up of Robert Richards, chairman, Paul Edwards, Robert Lehman, Howard Lynch, Bernard Meltzer, Robert Diskant, and Morton Berman—met regularly during the past summer to make arrangements for meetings, which will be held on the fourth Tuesday of each month, September through May.

ST. LOUIS

AT THE FIRST meeting of the fall season, which was held in St. Louis, A. F. Griffin, chief engineer for the Upper Mississippi Valley Division of the War Department, discussed river and harbor and flood control developments in the Upper Mississippi basin. Mr. Griffin also outlined the projects contemplated with funds currently made available, and described the methods by which federal projects are started, studied, and authorized.

PITTSBURGH

TALKS ON ORE bridges featured the October 3 meeting, which was a joint session with the Civil Section of the Engineers' Society of Western Pennsylvania. The principal speaker was George F. Wolfe, welding consultant for the Dravo Corp., Pittsburgh, who was assisted by E. M. Hayes and H. J. King, respectively electrical engineer and mechanical engineer for the organization.

SAN DIEGO

THE MISSISSIPPI River has been considered a national problem since 1800, Joseph F. Friedkin, engineer for the International Boundary and Water Commission, San Diego, told the members of the Section at a recent dinner meeting. Speaking on the "History of Flood Control of the Lower Mississippi," Mr. Friedkin pointed out that the portion of the river between Cairo and the Gulf has a drainage area of 1,240,000 sq miles, or 41 percent of the country. Annual flow amounts to 400,000,000 acre-ft, which would fill Hoover Dam in a week. Going back to 1770, when the first levies were built at New Orleans, the speaker reviewed all important attempts to bring the river under control, commenting particularly on the Jadwin Plan now nearing completion. Mr. Friedkin served with the Army Corps of Engineers during the war, and was assigned to flood control work on the river.

SEATTLE

Modern welding practice was discussed at a joint meeting with the Puget Sound section of the American Welding Society, which took place in Seattle on October 8. First on the program, Richard Ellis, Austin Co. representative in the Pacific Northwest, presented a paper on the company's standard H-section welded steel truss. A supplementary moving picture showed the exact results of tests on these trusses as well as the details of fabrication. Elmer Gunnette then led a discussion on the welding provisions of the Seattle and new King County (Pacific Coast uniform) building codes, comparing them with the AWS codes for 1941 and 1946. At another recent meeting, Prof. C. W. Harris, of the University of Washington, outlined the results of studies of the flow of water in pipes made under his direction at the university.

SPOKANE

USE OF air mass analysis in weather forecasting was described at a dinner meeting by Robert B. McComb, meteorologist in charge of the U.S. Weather Bureau at Spokane. In his talk Mr. McComb summarized recent advances made in the collection and analysis of meteorological data. Part of the meeting was devoted to making plans for a forthcoming joint meeting with the Student Chapters at Washington State College and the University of Idaho.

TENNESSEE VALLEY

THE CONSTRUCTION program of the DuPont Co., which is building a $20,000,000 nylon plant in the vicinity of Chickamauga Dam, was discussed by Grant E. Bubb, chief engineer for the project, at a recent smoker and dinner meeting held by the Chattanooga Sub-Section. Construction is well under way, according to the speaker, although shortages of material are causing some delays. To give an idea of the immensity of the structure, Mr. Bubb pointed out that 12,000 cu yd of concrete will be required for the foundations, walls and floor, and 2,500 tons of structural steel for the building frames. The walls and roof slabs are of precast concrete, making the structure entirely fireproof.

Guest speaker at the Holston Sub-Section's first meeting of the new season—held in Johnson City, Tenn.—was Walter Anderson, district ranger for the U.S. Forest Service. Mr. Anderson gave some interesting information on the work the Forest Service is doing, and on the national picture of timber use in relationship to our resources.

A talk on quantitative rainfall forecasting comprised the technical program at the Knoxville Sub-Section's first meeting of the fall season. This was given by T. W. Kleinsasser, who is in charge of the U.S. Weather Bureau office at the Knoxville Airport. The first quantitative forecasting unit was established in Knoxville several years ago.

TRI-CITY

ASCE PRESIDENT E. M. Hastings was guest of honor and principal speaker at a meeting that took place in Davenport, Iowa. In his talk Mr. Hastings emphasized the fact that engineers should increase their participation in community and national affairs, instead of confining themselves to purely technical interests. George S. Salter, ASCE Mid-West Representative, accompanied the President on his trip to the Tri-Cities.

WISCONSIN

IN AN ADDRESS before the Wisconsin Section, President Hastings stressed the growing public stature of the engineer, tracing a parallelism between this growth and the growth of the Society. He then outlined the goals of technical and professional advancement toward which engineers are moving, and showed how the Society can help in the attainment of these goals.

NEWS BRIEFS

Construction Volume Resumes Upward Trend After Slow Start

POSTWAR RECOVERY in construction volume which faltered early this year has apparently been resumed, John L. Haynes, chief of the Construction Division of the U.S. Department of Commerce, stated in his address before the recent annual meeting of the Producers' Council.

"Since May we have once again seen an expansion more rapid than is usual at this time of year," he said. "So far this year production of materials has been considerably higher than a year ago. For the first seven months production was 16 percent higher than in the corresponding period of 1946. The optimistic view of the present situation is further supported by the recent volume of work initiated. The amount of construction started indicates that the level of construction activity will continue upward (after seasonal adjustment) for at least several months to come. This is particularly true of residential construction, where the volume of work started is currently very high for so late a month in the year. In fact the 83,000 units started in August are a larger number than in any other month this year.

"In August of this year," Mr. Haynes continued, "private units started were some 34 percent higher than in August 1946. In considering residential construction, this steady increase in the volume of privately built units started is an indication both of the strength which private builders see in the current market and of the ability of private developers to expand their operations.

"But how about houses completed, which is our real goal? Through August a total of 498,000 private units have been completed this year—about $1\frac{1}{2}$ times the 209,000 units completed in the same period a year ago.

"Resumption of expansion in total construction, however, has not rested on residential construction alone. Conservation and development work has increased steadily as have public utility construction and building of stores, restaurants and garages.

"The material supply situation has clearly improved, from perhaps late 1946 at least until recently," Mr. Haynes added. "Construction time has been cut fairly sharply and many of the costs arising from the shortage of materials have disappeared. Construction can now be started with far more assurance as to the time of completion and as to the ultimate cost. At the same time I believe that there is less tendency to believe that a major drop in the level of construction costs is imminent. Whatever change of opinion has occurred on this point since last winter and spring is due partly to the fact that the present higher cost level has been with us a longer time and partly to the fact that the upward movement of prices of other goods has been renewed."

Data similar to those quoted by Mr. Haynes were recorded by the F. W. Dodge Corp., a fact-finding organization for the construction industry, which reported sharp gains in contracts awarded in August for construction in the 37 states east of the Rockies. A uniquely heavy contraseasonal upward trend was evidenced by the August total of $823,216,000, greater than the total for either June or July. This year's August total was 25 percent greater than that for July and 21 percent greater than that for August of last year.

Contract commitments for August 1947 were higher in all major classifications than in July or in August 1946, the F. W. Dodge Corporations' report continued. Non-residential building showed a gain of 15 percent over July and 37 percent over August 1946. Residential volume was up 28 percent over July and 9 percent over August of last year. Public works and utilities contracts showed gains of 35 percent over July and 21 percent over August of 1946.

The Department of Commerce report for September 1947 gives further indication of the upward trend in construction volume New construction put-in-place during September was estimated by the Department at $1,262,000,000, an increase of 2 percent over revised figures for August 1947 and a gain of 18 percent above September 1946. Privately financed new construction was valued at $950,000,000, or 2 percent above the revised estimate for August. Privately financed residential construction (excluding farm building) made a striking advance, reaching an estimated total of $475,000,000, or 3 percent above August and 33 percent above September of last year. Privately financed non-residential construction was $276,000,000, an increase of 3 percent over August. Total new public construction in September is estimated at $312,000,000, a gain of 3 percent over August. New public residential construction amounted to $9,000,000, the same as in August. Public highway construction for September reached $140,000,000, the Department estimates, an increase of 4 percent over August and a reversal of the customary trend.

Taking the first nine months of 1947 as a whole, private residential construction totaled $3,268,000,000, a gain of 50 percent over the same period of 1946. Construction of all types was estimated at $9,022,000,000, a gain of 30 percent over the corresponding January–September period of last year.

Launched Tank Barge Splashes Into Ohio River

WALL OF WATER is created by one of eight new chlorine tank barges—first ever specifically designed and built for such service—as it slides into Ohio River at Dravo Corporation's Neville Island shipyard. Steel barges designed to effect more economical delivery of bulk chlorine to large users along inland waterways, are 175 ft long, 26 ft wide and 11 ft deep. Chlorine is carried in four 64-ft welded and annealed steel cylinder tanks 8 ft 9 in. in diameter, two fore and two aft, separated by transverse bulkhead.

Vital Need for Advance Planning of Local Public Works Is Emphasized

FEDERAL FINANCIAL assistance to state and local governments to aid them in planning of local public works has been advocated for many years by the Society. The vital need for continuation of an advance planning program was emphasized in a talk before a recent meeting of the Producers Council in New York City.

Citing the $2.3 billion backlog of public construction represented by the advance planning program of the Bureau of Community Facilities, Federal Works Agency, General Fleming stated that total public construction in 1947 would total $2.9, of which $1.7 billion would be financed by states and local communities.

"I ask you to contrast that figure of $1.7 billion of state and local construction with the total $2.3 billion backlog of state and local projects brought to the planning stage during the life of the Advance Planning Program," General Fleming said. "I think you can judge for yourselves the need for a continuation of the program."

The Advance Planning Program of the Bureau of Community Facilities, FWA, terminated June 30, an appropriation of $65,000,000 having been utilized to develop the estimated $2.3 billion backlog of local public works throughout the country. Under this program funds were advanced to communities to finance the preparation of plans and specifications on local public works projects. Federal advances are repaid without interest when construction is begun and the repayments are returned to the general fund of the U.S Treasury.

General Fleming advocated better timing for public construction to overcome conditions of the past when public and private construction tended to "move in the same direction, both coming into the market on the upswing, both dropping off on the downswing."

The Federal Works Administrator said that close scrutiny of federal-aid highway bids during the past year had produced economies that will be translated into more mileage in highways in 1948. He predicted that road construction in 1948 would gain a third over 1947. The Public Roads Administration of the Federal Works Agency, however, will not compete with privately financed construction for the services of contractors or skilled workers nor will it make large demands for materials.

"We do expect to see to it that the federal government gets its full money's worth for the construction dollars we spend," the speaker stated.

Rejection rate on bids for road construction has steadily declined, General Fleming said, as a result, in his opinion, of a better job of cost analysis on the part of individual contractors.

General Fleming advocated passage of legislation now before Congress to authorize a fund of $100,000,000 a year to be lent to states, cities and individual enterprises for stream pollution abatement projects. This program should be jointly administered, the speaker said, by the Public Health Service of the Federal Security Agency and the Federal Works Agency.

He outlined the activities of the past year in the Veterans Educational Facilities Program, administered by the Bureau of Community Facilities, FWA. Approximately 1,700 educational institutions obtained needed classroom, laboratory and cafeteria space by the transfer of government surplus buildings to college campuses to accommodate large veteran-student enrollment increases. The program involved an appropriation which totaled $75,000,000.

No extensive federal building program was seen during the coming year by the speaker. The Public Buildings Administration, FWA, he said, will concentrate its attention on drafting plans for the future construction of badly needed projects. Despite need for post offices, courthouses and office buildings, decision has been made to postpone such construction for the time being, General Fleming said.

October Construction Bid Calls Announced by Bureau af Reclamation

CONSTRUCTION PROJECTS scheduled to get under way in Wesern states soon are listed in the Bureau of Reclamation's *Advance Construction Bulletin* for October. Bid calls are published for information only and are subject to revision, the *Bulletin* states. For further information on these projects, address the Chief Engineer, Bureau of Reclamation, Denver 2, Colo., or the nearest regional director.

EARTHFILL DAM

Heart River Unit, Missouri Basin Project

Location: 18 miles south of Glen Ullin, N. Dak., 50 miles southwest of Bismarck.

Work: Construction of Heart Butte Dam, an earthfill structure approximately 125 ft in height, 1,850 ft in length; and relocation of 7½ miles of State Highway No. 49, gravel surfacing.

Excavation, dam	2,000,000 cu yd
Excavation, highway	167,000 cu yd
Concrete	10,000 cu yd
Earthfill	129,000 cu yd
Gravel surfacing	16,300 cu yd
Furnishing and placing reinforcement steel	1,733,000 lb

Time Allowed for Completion: 925 days.

ACCESS ROAD

Frenchman-Cambridge Unit, Missouri Basin Project

Location: Near Cambridge, Nebr.

Work: Construction of approximately 7.5 miles of gravel road.

Excavation	105,000 cu yd
Gravel surfacing	18,000 tons
Concrete	300 cu yd
Furnishing and placing reinforcement steel	55,000 lb
Piling	1,500 ft
Finishing road and roadway	7.5 miles
Furnishing and placing 24-in. to 144-in. corrugated metal pipe	1,600 ft
Furnishing and placing structural steel	135,000 lb

Time Allowed for Completion: 150 days.

LATERALS AND STRUCTURES

Tucumcari Project, New Mexico

Location: Vicinity of Tucumcari, N.Mex.

Work: Construction of earthwork and structures for Saxon lateral to irrigate approximately 150 acres.

Excavation	5,650 cu yd
Laying concrete pipe	370 ft
Concrete in structures	54 cu yd

Time Allowed for Completion: 120 days.

LATERALS AND STRUCTURES

W. C. Austin Project, Oklahoma

Location: Vicinity of Altus, Okla.

Work: Construction of earthwork and structures for Ozark laterals to irrigate approximately 9,300 acres.

Excavation	192,000 cu yd
Concrete in structures	1,700 cu yd
Laying concrete pipe	4,470 ft
Installing gates	46,700 lb

Time Allowed for Completion: 270 days.

LATERALS AND STRUCTURES

Deschutes Project, Oregon

Location: Vicinity of Madras, Ore.

Work: Construction of earthwork and structures for Mud Springs Creek lateral system to irrigate approximately 8,500 acres

Excavation	459,500 cu yd
Concrete in structures	2,115 cu yd
Laying concrete pipe	5,400 ft
Furnishing and placing reinforcement steel	243,000 lb

Time Allowed for Completion: 365 days.

New York City Starts New $12,771,000 Housing Project

COMPLETION IN DECEMBER of the first unit in the group of 13 buildings known as Amsterdam Houses, a New York City Housing Authority project now under construction, will be another step in alleviating the city's acute housing shortage by aid of public funds. When finished, the project will provide a total of 1,084 apartments and will constitute one of five such developments, four in Manhattan and one in Brooklyn, being erected under the City Housing Authority and the State Division of Housing.

Financed by state funds, the total cost of the Amsterdam Houses is estimated at $12,771,000, including cost of land, fees, resettlement of displaced tenants and actual cost of construction.

Three proposals to provide for and encourage further housing developments will be decided by public ballot on November 4 under which New York State would be empowered to create a new public housing fund of $135,000,000 to enable it to increase subsidies for holding down rentals in projects such as the Amsterdam Houses.

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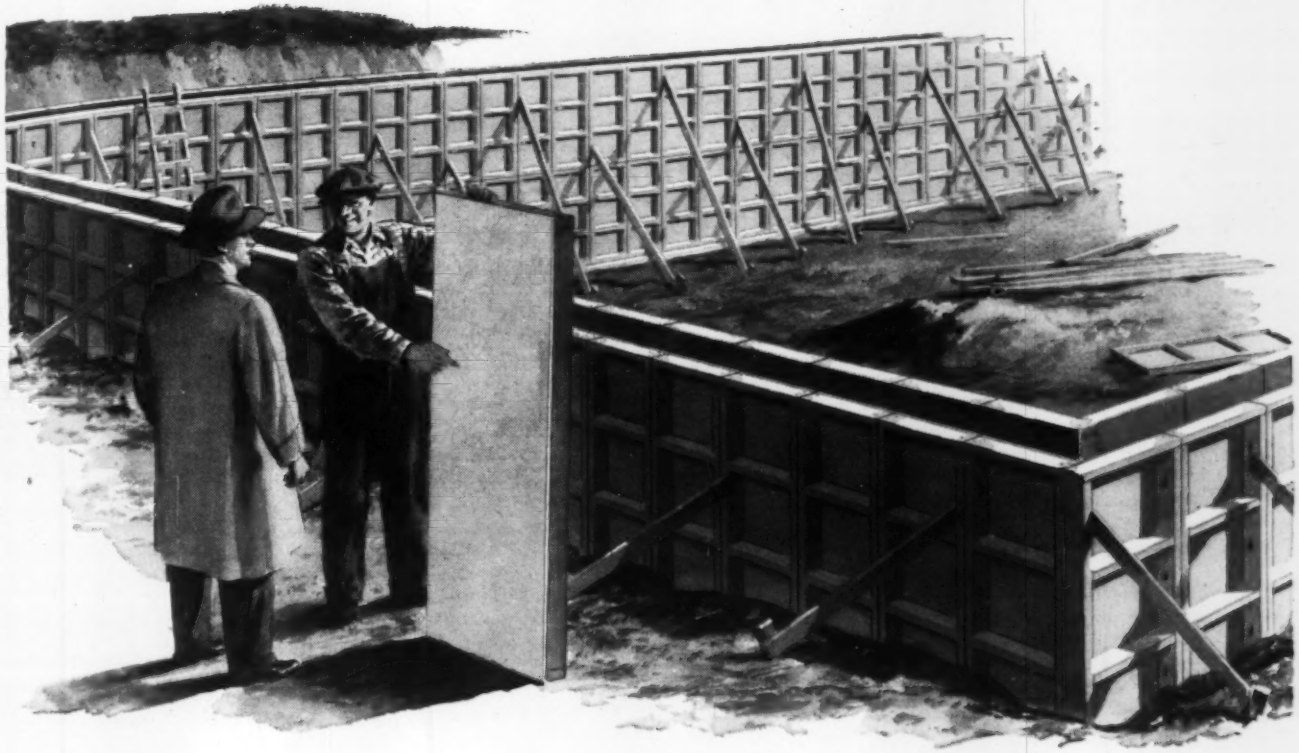

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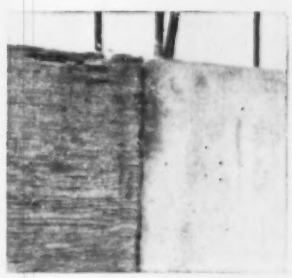

A standard plywood form produced the rough-surfaced concrete on the left. Note how smooth the finish on the right looks—the work of a KIMPREG + Plywood form. Both panels have had many re-uses.

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Slight Upward Trend Characterizes Building Costs, AGC Survey Reveals

COSTS OF BUILDING CONSTRUCTION are continuing a slight upward trend according to the results of a recent national telegraphic survey of 101 chapter managers and secretaries and elected directors of The Associated General Contractors of America. The membership of the association includes over 4,300 general contracting firms throughout the country.

The upward cost trend revealed by the survey follows increases which can be perceived for commodities and services in general and is principally caused by higher material costs, recent wage increases for construction trades in many cities, and a low labor productivity, which continues below prewar standards of output.

The survey was made to provide a current outlook on conditions in the construction industry for study by the governing and advisory boards of The Assoicated General Contractors of America at their fall meeting in Des Moines, Iowa.

A total of 114 replies were received to the telegram asking for cost information and for "significant information on the following: Is more or less work coming on the market? What is the availability (locally) of materials, equipment, manpower?"

A total of 83 percent of the building chapter managers and building construction directors of the association reported that prices were moving slowly upward; 82 percent of the highway chapter secretaries or managers and directors noted the same; and half of the heavy construction chapters reported slight cost increases. Costs of heavy engineering construction such as dams and earthmoving projects are remaining steady in many areas.

As regards work coming on the market, 50 percent of those replying in the building field reported an increase in volume, 55 percent in the highway field, and 70 percent in the heavy construction field.

Among the reasons given for increased building construction volume was that a certain amount of the new work includes needed community facilities, such as schools and hospitals, and that prospective owners for other types of building construction have recognized the fact that construction prices are not out of line with those for other commodities and are not likely to decrease drastically in the near future. Heavy construction chapters and directors attributed the increase in work volume to a sharp jump in powerplant construction and sewer, water, and sanitary facilities construction, and an increased amount of heavy industrial construction.

Material shortages were reported in all three fields, but building and highway contractors appear to be most affected by inadequate supplies. Replies showed 83 percent reporting shortages in the building field and 55 percent in the highway field. In the heavy construction field, only 30 percent of the chapters and directors indicated material shortages.

As for the supply of construction equipment, the survey indicated that highway contractors are the most concerned by the lack of new machinery, 55 percent noting shortages. Equipment shortages were also noted in 50 percent of the replies from the heavy construction industry, but only 17 percent in the building division reported difficulties in obtaining construction machinery.

Shortage of manpower was reported by all building division representatives; by 36 percent of the highway division representatives; and by 40 percent of the heavy construction representatives. Bricklayers, plasterers, lathers, carpenters, plumbers, electricians, iron workers, and skilled highway and heavy construction workers were among the most frequently mentioned crafts in which there are shortages of manpower.

Problems of Planning Our Large Cities Are Discussed

DECENTRALIZATION AND BLIGHTED areas as two factors causing most serious perplexity in the evolution of the modern city were discussed by James W. Follin, M. ASCE, assistant administrator of the Federal Works Agency in a recent address before the California Council of Architects at Catalina Island. "Decentralization," he said, "is causing financial headaches in the cities, and the universal urban disease called 'blight' is causing trouble nearly everywhere." To cure these evils, metropolitan planning and urban redevelopment under coordinated agencies "with federal aid or at least federal credit of some kind will be needed." Urban redevelopment, he explained, includes not only housing but public works and community facilities.

"Urban developers," continued Mr. Follin, "are launching an attack to bring about some changes and improvements in the very centers of our original cities. New layouts for whole sections and new structures conforming to a city plan are pretty well along. The process they call urban redevelopment begins in the old, mostly downtown sections."

"But metropolitan planning, as some authorities are insisting," he continued, "will have to go hand in hand with urban redevelopment if the old city is to be renewed and is to be able at the same time to meet the expenses of the operation."

"The older community, losing its people and their taxes, cannot afford to renew itself, cannot provide modern transportation, cannot continue to support a combined business, industrial, public works and services center unless the metropolitan populace as a whole that has the advantage of all these things also plays on the team, shares costs as well as benefits."

Some little progress has been made along the lines of cooperative planning between the central city and its peripheral communities, such as between Milwaukee, Los Angeles and Louisville and their county areas. A number of states have regional planning powers permitting cities and counties to prepare metropolitan area plans.

Discussing several shelved bills that have come before Congress, Mr. Follin said the probability is "that the federal government will ultimately, perhaps soon, assume a role of collaboration, and probably not much more than that, with the cities in this field." Concluding his address, he stated that the Federal Works Agency, already in a real sense in the urban redevelopment business, was ready and waiting to undertake whatever part Congress decides the federal government will henceforth play in urban redevelopment.

War Department Leads Drive to Spur Steel Scrap Output

BETWEEN TWO AND THREE MILLION tons of potential scrap in the shape of surplus war material possessed by various government agencies can be made available by effective disposal programs of those agencies, according to Robert W. Wolcott, chairman of the Steel, Foundry and Scrap Industries' Committee for Expediting Iron and Steel Scrap. Mr. Wolcott states that "practically the only sources of additional scrap to increase the present national inventory are the various agencies of the government."

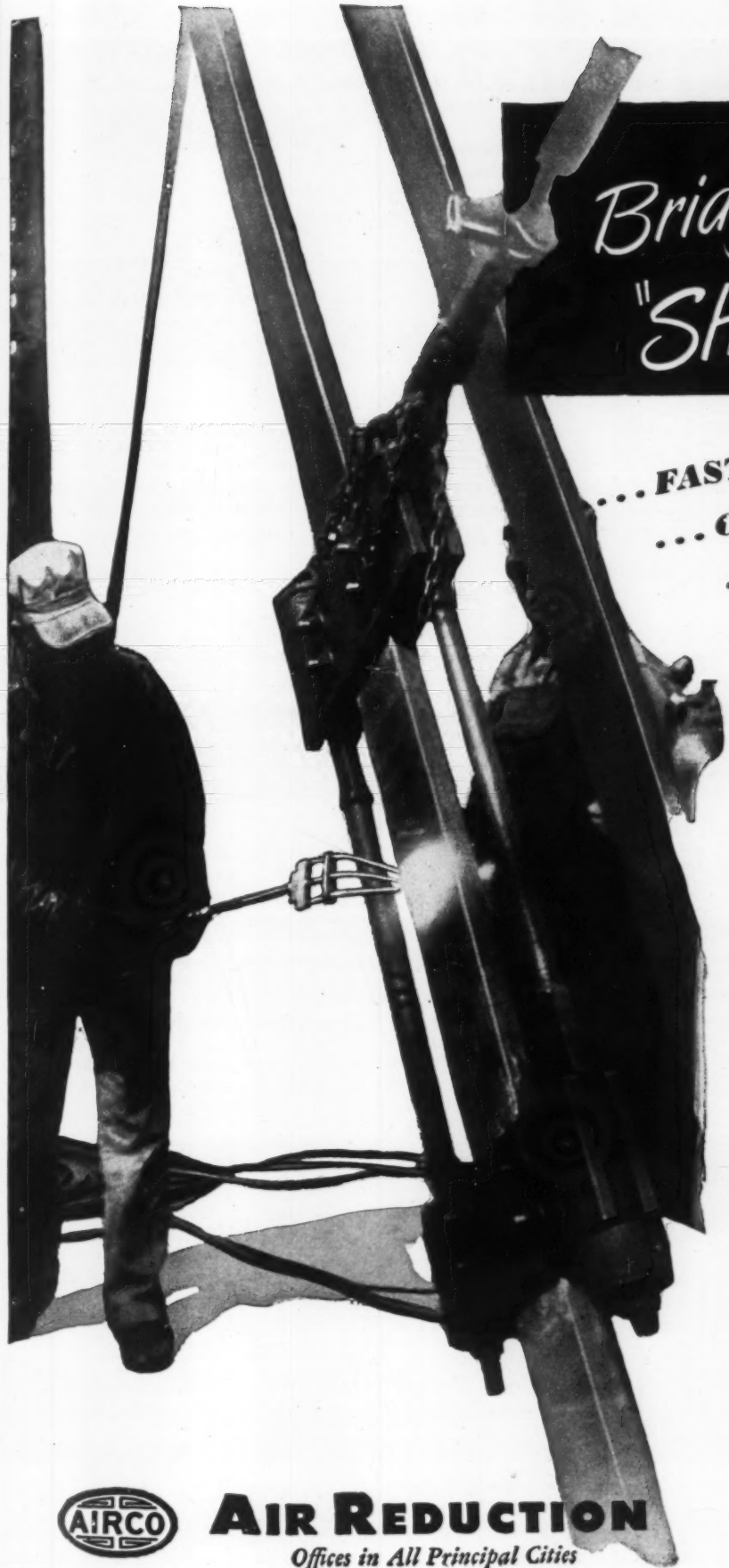
The War Department has recently announced its intention of accelerating the flow of surplus iron and steel under its control and expects to produce approximately 500,000 tons of scrap from obsolete or obsolescent ammunition by July 1948. Secretary of the Army Royall has designated Mr. Wolcott's committee to serve with the War Department in carrying out its program.

Progress in Revision of Building Codes Is Cited

STEADY PROGRESS is being made in the modernization of local building codes as a result of the growing acceptance of standard code provisions developed by building code officials, testing laboratories, and other groups, according to George N. Thompson, assistant chief of the Building Technology Division of the National Bureau of Standards.

Addressing the annual meeting of the Producers' Council—held recently in New York City—Mr. Thompson hailed as a "healthy sign" the fact that "a number of responsible organizations are willing to take the trouble to examine all the evidence affecting safety in buildings and to develop recommendations for general use."

In particular, the speaker cited the work of the Building Code Correlating Committee of the American Standards Association, stating that it is the one organization that correlates the recommendations of the other groups offering building codes. Under its direction some ten building code standards have been produced and more are on the way.



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Studies of Urban Problems Urged by Traffic Engineer

GREATER CONFIDENCE between transit companies and the public and better studies of a city's needs are essential if real progress is to be made in solving city traffic problems of today and tomorrow according to Leslie Williams, Assoc. M. ASCE, in a recent address before the American Transit Association at Atlantic City.

Mr. Williams, city planning and traffic engineer for the Association, stated further that, "Mass transit has a future in the city of today and tomorrow if the growing interest of public officials is any index of the future. But planners and traffic engineers represent only a limited section of the public." The speaker noted that public relations of transit companies have been deficient and that they cannot operate independently of the public interest. The public, he said, should be taken into confidence by the companies and advised of their plans and operations.

"Few are the companies," Mr Williams stated, "who are readily conversant with the ecological aspects of the people residing in the service area—the types of people, their occupations, interests, income levels, homes, and other characteristics; and few indeed are the companies familiar with the changing densities of population in each area served."

The speaker expressed the opinion that a much greater knowledge by transit companies of city planning, their better acquaintance with master plans and cooperation with planning commissions of our cities is essential if increasing traffic problems are to be solved.

A "Manual of Transit and Traffic Studies," recently released by the American Transit Association, is reviewed in the "New Publications" department of this issue.

Report Outlines Expansion in Missouri River Basin

DEVELOPMENT of the Missouri River Basin as authorized by Congress under the 1944 Flood Control Act holds great possibilities for the agricultural, industrial and mineral expansion of that area and contributes to a more balanced economy in the greatest food-producing section of the nation according to a recent report made to the Corps of Engineers. The two-volume report prepared by the Midwest Research Institute, Kansas City, Mo., describes the Missouri Basin as a "vast storehouse of mineral and other resources" and states that the time has come to "develop the river industrially."

The report states that three major interdependent economic factors are involved in the successful development of the region: (1) The economy of the region is greatly dependent upon the annual success or failure of agriculture; (2) an unbalanced economy in the basin cannot be alleviated without satisfactory industrialization, which cannot gain a firm foothold without increased population in the area; and (3) the population in the region is continuing to decrease and that trend can only be averted by industrialization and more intensive farming. Under the development scheme some 5,000,000 acres of new land will be served by irrigation projects.

Details regarding the distribution of mineral resources, crops suited to the soils and climate and fuel reserves, solid and liquid, are given in the report. It states that this region "contains the greatest solid fuel reserves in the nation." Production of coal in the basin in 1943 was 36,000,000 tons. Should this production keep pace with growth of population, agriculture and industry, the coal output is estimated at 39,000,000 tons by 1960 and 43,000,000 tons by the year 2000.

Continued Federal Aid Is Urged for Highway Construction Program

AUTHORIZATION BY CONGRESS for continuation during 1949, 1950 and 1951 of the annual sum of $500,000,000 apportioned for federal-aid highway construction under the 1944 Federal Aid Highway Act, is asked in a resolution passed at the 33rd Annual Convention of the American Association of State Highway Officials held recently in New York City.

The resolution is based on the fact that the policy of Congress in writing the Act was to assure the states a definite annual sum "enabling them to intelligently plan a continuing program of highway improvement," and that "there is an urgent need for orderly continuation of this federal-aid highway construction, which continuation requires advance surveys and planning." Congress was also asked to appropriate funds out of the $75,000,000 authorized by the 1944 Act for improvement of forest roads on which only $9,800,000 has been expended to date.

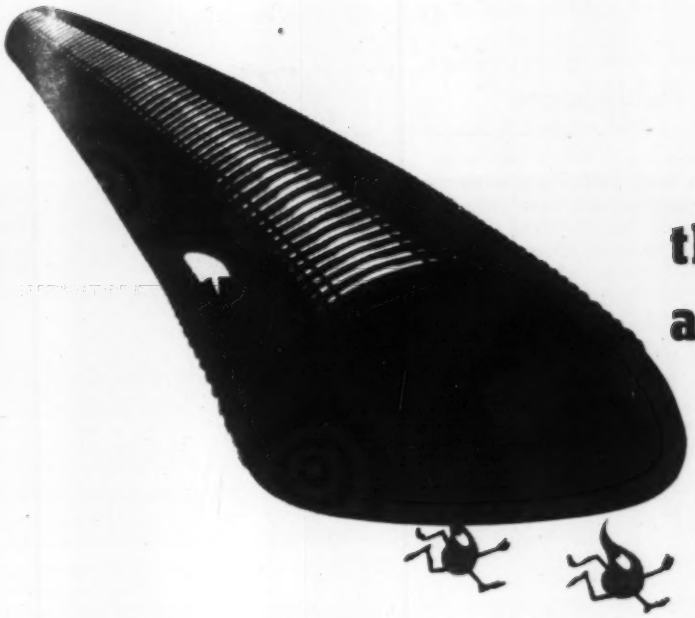
Another resolution urged study and development by all states of long-range programs for adequate improvement and continued maintenance of several systems of highways. The 1947 survey in California was cited as an example of the planning necessary to insure "effective and economical state and national highway administration."

Governor Dewey addressing the Convention stated that "society cannot survive without adequate means for the movement of goods and people" and that "highways are still, as always, the basic method of transportation."

"If we are going to maintain the social and economic structure of the State of New York," he continued, "we must, between now and 1960, spend the staggering total of two billion dollars on highways."

Plans have been approved for improvement of 10,210 miles or 4 percent of the total mileage in federal-aid primary systems, while programs have been completed for another 10 percent, according to Public Roads Commissioner Thomas H. MacDonald, Hon. M. ASCE. In the secondary system improvements have been planned for 32,000 miles or 9 percent of the total mileage, while work has been done or contracted for on 18,300 miles. Plans have been approved to the sum of $178,000,000 or 50 percent of federal authorization for urban highways, 65 percent of which are completed or under contract. Total highway construction under contract between January 1, 1946, and August 31, 1947, amounts to $1,645,000,000, with $720,000,000 available for remaining work under the program.

APPROPRIATION OF $75,000,000, of which $9,800,000 has been expended, was set aside by Congress in 1944 for improvement of forest access roads such as those used in lumber operations by Hammond Lumber Co. of Samoa in Big Lagoon area near Cranell, Calif. Huge redwood logs are hauled over distance of approximately 1 mile to railhead on ten 200-hp diesel-engine Mack trucks with Fruehauf trailers. Trucks and trailers are equipped with pneumatic Goodyear Hard Rock Lug tires for operation over rough terrain.



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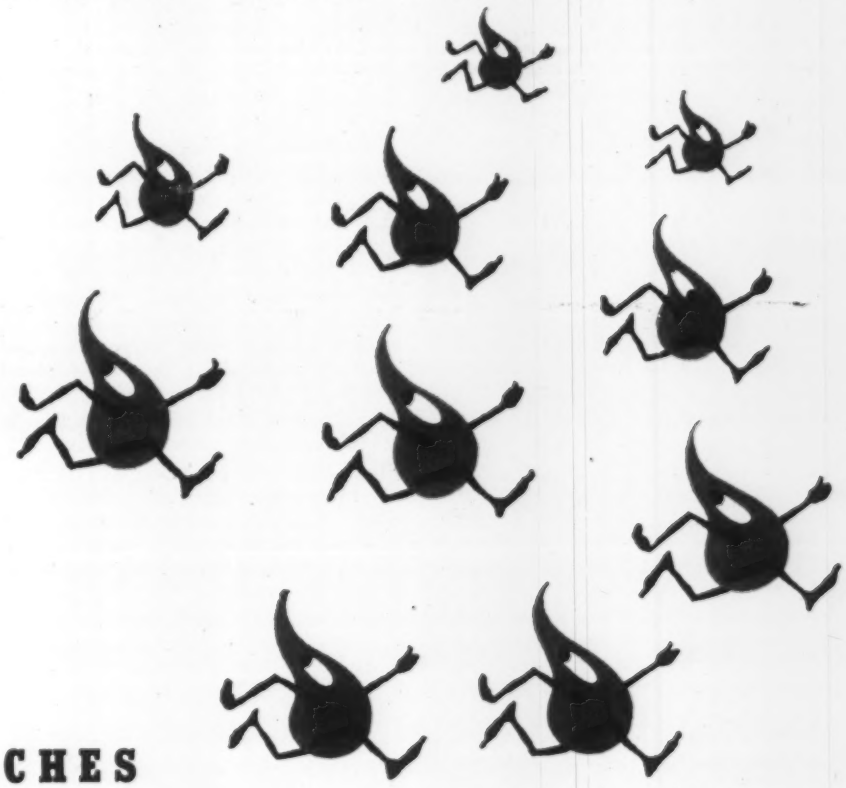

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ARMCO PIPE-ARCHES

Hurricane Damage Shows Need for Better Building Codes

IN HIS RECENT TALK on the 1948 plans of the Federal Works Agency before the Producers Council in New York, Maj. Gen. Philip B. Fleming, Federal Works Administrator, digressed from his assigned topic to comment briefly on a survey of the hurricane-stricken areas of Louisiana, Mississippi and Florida. The exploratory trip was made at the request of President Truman to determine the extent of storm damage in those states, to find out what steps were being taken to alleviate distress and to make recommendations for further moves the federal government might make to help out.

In reporting on the areas studied General Fleming stated: "One thing stands out in my recollection of the trip and I would like to impress it on you gentlemen who are among the key personnel of the building and building materials industry. The storm damage to buildings was confined to flimsy structures. In Florida, where they had two bad blows twenty years ago, they revised their building codes and the buildings built since then have been well constructed of approved materials. These buildings rode out the storm intact. In Mississippi, however, where they had not had a hurricane for 40 years, many tourists camps and other buildings of flimsy construction went down before the wind and there was an unnecessary loss of life.

"If one needed a practical demonstration of the value of a good building code, I certainly saw it last week. I can't urge too strongly that you men give your wholehearted support to drives for good building codes in your communities and I would even go further—I would urge you to initiate campaigns for sound building codes where no one else has taken that step.

"If one life is saved because your city has put on its ordinance books a good building code, you would feel well repaid, leaving aside entirely the calamitous effect of a devastating wind storm on buildings not built to withstand its fury."

Commission Presents Plan for Cleveland Improvement

AT A RECENT PUBLIC HEARING on a comprehensive, long-range recommendation for the improvement of the central section of Cleveland, based on a four-year study by the City Planning Commission, a general plan was presented for the improvement of a 30-sq-mile area. In this region, embracing almost half of the city area and more than half of its population, have been found the principal problems of traffic congestion, blighted areas, confused land use, depreciation of property values as well as deficiencies of play areas and other public services.

The commission's plan recommends allocation of land for industry, commercial development, major retail centers and different types of residential areas. It further recommends slum clearance and redevelopment of areas in accordance with population densities.

New Publications

Data on Cleveland. Many pertinent facts about Cleveland, Ohio—presented as a large and growing market—are given in the 1947 edition of the *Cleveland Market Data Handbook* by Howard Whipple Green, M. ASCE. The volume, which sells for $2.50, is being distributed by the Real Property Inventory of Metropolitan Cleveland, 1001 Huron Road, Cleveland 15, Ohio.

Buckling of Webs. Investigations of the buckling of webs in deep steel I-girders—made at the Institution of Structural Engineering and Bridge Building of the Royal Institute of Technology, Stockholm—are reported in English in a 200-page volume. Authors are George Wastlund and Sten G. A. Bergman.

Community Development. Practical methods by which communities can determine the type of expansion best adapted to their economic requirements are discussed in a recent manual of the New York State Department of Commerce, entitled "Your Home Town's Future." Consulting service and assistance for those interested in business and community development are provided by the New York State Department of Commerce, and inquiries should be addressed to Harry E. Clinton, in care of the Department, 112 State Street, Albany 7, N.Y.

Sanitary Engineering. With the issuance of Vol. 1, No. 1 of *Organo Official de la Asociacion Interamericana de Ingenieria Sanitaria* (Journal of the Inter-American Association of Sanitary Engineering), a new sanitary engineering quarterly is launched. The articles, which deal chiefly with South American sanitation problems and practices, are largely in Spanish, though there are a few in English translation. The subscription price to members of the Inter-American Association of Sanitary Engineering is $3 per year; single copies are $1. Inquiries should be addressed to the Association, N.W. Corner 17th and Constitution Avenue, Washington 6, D.C.

Sedimentation Studies. Investigation of the problem of sedimentation in the utilization of impounding reservoirs is reported in Bulletin No. 37 of the State of Illinois, entitled "The Causes and Effects of Sedimentation in Lake Decatur." Cooperating agencies in the preparation of the study were the Illinois State Water Survey, the Soil Conservation Service, and the Illinois Agricultural Experiment Station. The bulletin may be obtained from the Illinois State Water Survey Division, Urbana, Ill.

Maps. New navigation maps of the Mississippi River from Cairo, Ill., to the Gulf of Mexico—drawn to an approximate scale of 1 in. to the mile and showing the location of navigation lights and channel line—are now available at a cost of 75 cents per set. Checks should be made payable to the Treasurer of the United States and mailed to the Mississippi River Commission, P.O. Box 80, Vicksburg, Miss.

Also available is a map showing revision of harbor lines for the East River, New York, from East 4th Street to East 66th Street, Manhattan, and from North 6th Street, Brooklyn, to 40th Avenue, Queens. Prints of the new map may be obtained from the New York District Engineer Office, 120 Wall Street, New York 5, N.Y.

Traffic Congestion. To obtain the cooperation of city officials in relieving traffic congestion, the Chamber of Commerce of the United States has issued an interesting study of traffic engineering conditions under the title, *Making Better Use of Today's Streets*. Graphic before-and-after examples of improvements that have been effected in a number of cities suggest possibilities for traffic relief. Of special value is a check list of questions with a box score, that will enable city officials to present the traffic situation graphically to local chambers of commerce. The study was made by D. Grant Mickle, M. ASCE, with the cooperation of the Automotive Safety Foundation. Copies may be obtained from the Transportation and Communication Department, Chamber of Commerce of the United States, Washington, D. C., at 35 cents each. Quantity prices will be given on request.

Highway Research. As a continuation of its Wartime Road Problems series, the Highway Research Board has issued "Current Road Problems No. 4-R," a revision of its 1942 edition. The present pamphlet makes available current practices in the use of bituminous materials as well as additional information on mixtures of soils and other materials for slurries used in mudjacking. Inquiries should be addressed to the Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C.

Building Standards. A uniform basis for measuring the adequacy of building materials and home construction methods is the objective of *Performance Standards*, a new publication of the Housing and Home Finance Agency. The bulletin proposes performance standards for the various structural elements of the house and gives data on insulation requirements. Copies are available upon application to the Housing and Home Finance Agency, Washington 25, D.C.

Wood Research. Recent exposure tests on cross-laminated oak panels—made by the Virginia Polytechnic Institute Wood Research Laboratory in collaboration with the Tennessee Valley Authority—are described in Bulletin No. 66 of the Institute, entitled "Limitations in Cross-Laminating of Oak Under Extreme Service Conditions." E. George Stern, Assoc. M. ASCE, director of the V.P.I. Wood Research Laboratory, is author of the bulletin, which may be purchased from the Engineering Experiment Station at the Institute, Blacksburg, Va. The price is 50 cents.

Traffic Studies. To provide traffic engineers and transit companies with background material for studies of the pressing problems of urban transportation and traffic movement, the American Transit Association has issued a *Manual of Transit and Traffic Studies*. Twenty basic studies comprise the manual, which was prepared by Harold F. Hammond, Assoc. M. ASCE, former manager of the Washington office of the Association. Copies may be obtained from the American Transit Association, 292 Madison Avenue, New York 17, N.Y., at a

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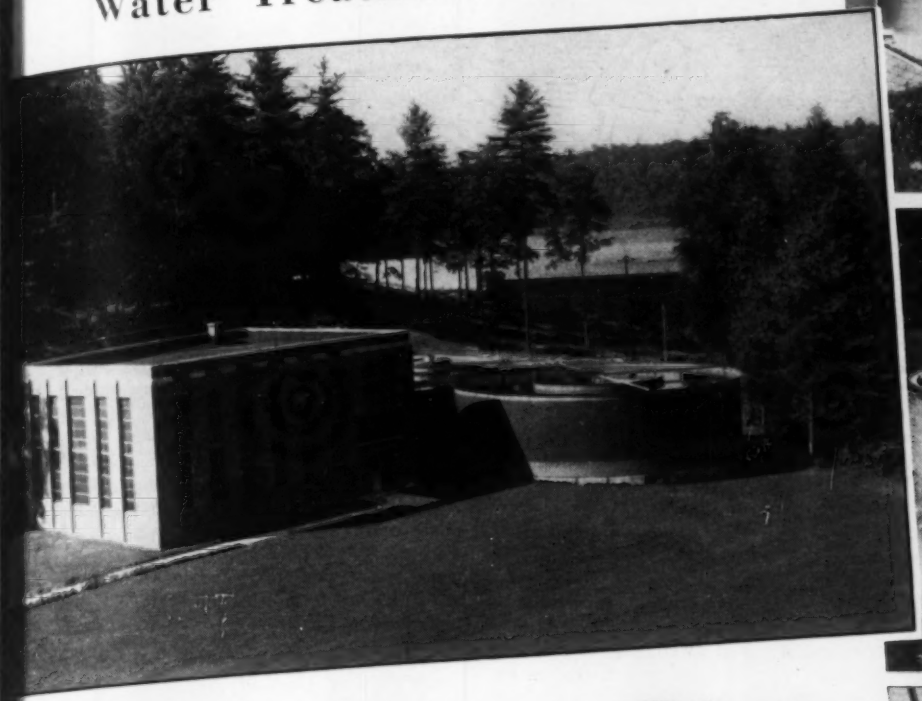
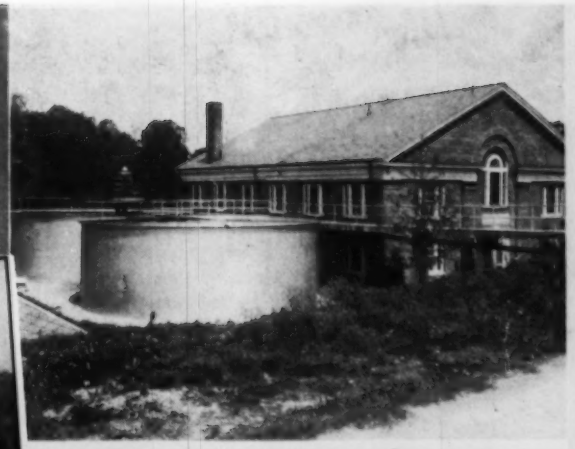
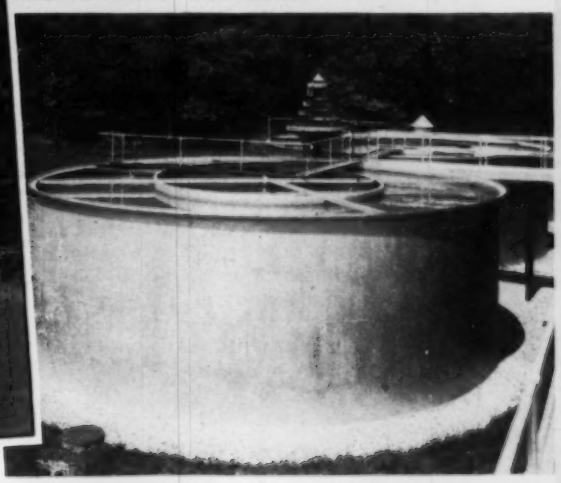
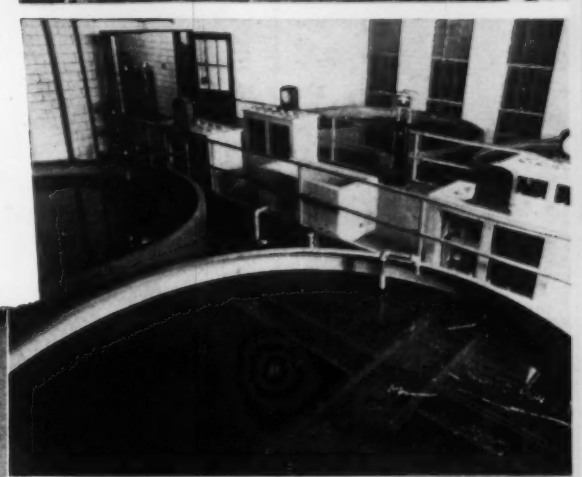
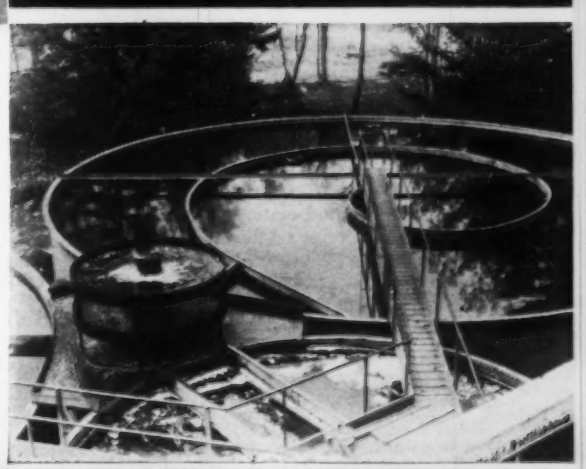






Steel Filtration Plants
by
Pittsburgh-Des Moines





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cost of $2 for members of the Association and $3 for others.

Water Treatment. The treatment of municipal and industrial waters is the subject of Bulletin No. 8 of the Solvay Technical and Engineering Service. The bulletin is offered without charge by the Solvay Sales Corp., 40 Rector Street, New York 6, N.Y.

Geological Survey Maps and Reports. A number of new maps and reports have been released by the U.S. Geological Survey. The list of new publications includes:

Geophysical Investigations, Preliminary Map 4, Plates 1 and 2, of the "cryptovolcanic" area in the vicinity of Kentland, Ind. These maps are in open file in the Office of the State Geologist of Indiana, Indiana University, Bloomington, Ind., and in the Office of the U. S. Geological Survey, Washington, D.C.

Two reports on iron-ore deposits—one in the Clear Water District, Idaho County, and the other in the Iron Mountain District, Washington County, Idaho—are in open file in the offices of the Survey in Washington, D.C.; at 707 Peyton Building, Spokane, Wash.; and at the University of Idaho, Moscow, Idaho.

"Records of Water Levels in Wells in the Knife River Valley, N.Dak.," may be consulted in the Survey offices in Bismark, N.Dak., and Lincoln, Nebr., and the offices of the Bureau of Reclamation in Billings, Mont.

"Records of Ground-Water Levels in the Upper Missouri-Souris Area, Montana," are filed in the office of the State Engineer at Helena, Mont., and in the Survey offices in Helena, Mont., and Lincoln, Nebr.

Report on "Ground Water in the Prineville Area, Oregon," is in open file at the Survey office in Portland, Ore., and in the office of the State Engineer at Salem, Ore.

Report on "Ground-Water Conditions in the Vicinity of Mason, Mason County, Texas," is filed at the Survey offices in Austin, Tex., and in the office of the State Board of Water Engineers, Austin.

"Ground Water in Northwestern Nolan County, Texas," by D. B. Knowles, is in open file in the Survey office at Austin, Tex.

Memorandum on "the decline of artesian head that will be produced by pumping from wells at the Kankakee Ordnance Works, near Joliet, Ill.," may be inspected in the Survey offices in Indianapolis, Ind., and Urbana, Ill., and in the office of the State Geologist at Rolla, Mo.

Report on ground-water conditions in the vicinity of Exeter School, Washington County, Rhode Island, is filed in the Survey office in Boston, Mass., and in the office of the Rhode Island Industrial Commission, Providence, R.I.

Report on "Ground Water for Irrigation in Box Butte County, Nebraska," is in open file at the Geological Survey Office in Lincoln, Nebr.

Report on "Geology and Ground Water Resources of the Santa Maria Valley Area, Santa Barbara County, Calif.," with a section on surface-water resources, may be inspected in the offices of the Survey in Santa Barbara and Long Beach, Calif.

R. Robinson Rowe, M. ASCE

"IT HADN'T OCCURRED to me," began the Professor, "that there was any practical application for Guest Professor D. Sy Ford's odd-weight detection problem, but I have one inquiry from a traffic engineer asking for help. His parking meters take in $1,000 in nickels and $500 in pennies per day, of which all pennies are healthy, but 15 nickels, on the average, are numismatically anemic. But first let's let Sy unravel his question."

"Mine was a question in extrapolation," said Professor Ford. "If the odd weight of 4 can be spotted in 2 weighings on a 2-pan balance and the odd one of 12 in 3 weighings, how many can be tried in 4 weighings?"

"I'd say 81," replied Joe Kerr, "and add that you can try 9 in 2 weighings and 27 in 3 weighings. At any stage, you divide the lot in 3 parts, put one part in each pan and the third in the boneyard. If the pans balance, the odd one is in the boneyard; otherwise the anemic one is in the pan that rises. In any case only one third remain for the next weighing, so the number that can be tried in n weighings in 3^n."

"Unnnh-uh." yelled Cal Klater. "He didn't say the odd one was anemic. If it was obese it would be in the lower pan, but since you don't know whether it's anemic or obese, you would have two-thirds left for the next weighing. I think the answer is 36, but I couldn't prove it."

"That's close, Cal, but I can show you how to try 38. In the cryptic equations to follow, the signs of equality and inequality separate the lots in each pan and indicate the balance. To the right, after a colon, is the unknown part of the boneyard. The status of lots is indicated by subscripts: x, h or l if suspected of including an odd, heavy or light weight, respectively; n if all are known to be normal. A double subscript indicates a change in classification as a result of the weighing. Numbers in bold face indicate the lots still suspected. Letters in parenthesis are a key to the series of weighings, that is (a), (ab), (abb) and $(abba)$ are in such a series. Series which would be equivalent to one given by exchanging h and l are omitted:

$$13_{xn} = 13_{xn} : \mathbf{12}_x \quad (a)$$
$$\mathbf{13}_{xh} > \mathbf{13}_{xl} : 12_{xn} \quad (b)$$
$$4_{xn} = 4_{xn} : \mathbf{4}_x \quad (aa)$$
$$\mathbf{4}_{xh} > \mathbf{4}_{xl} : 4_{xn} \quad (ab)$$
$$5_{hn} + 5_{ln} = 4_{hn} + 4_{ln} + 2_n : \mathbf{4}_h + \mathbf{4}_l \quad (ba = ab)$$
$$\mathbf{5}_h + 5_{ln} > 4_{hn} + \mathbf{4}_l + 2_n : 4_{hn} + 4_{ln} \quad (bb)$$
$$3_{xn} = 3_n : \mathbf{1}_x \quad (aaa)$$
$$\mathbf{3}_{xh} > 3_n : 1_{xn} \quad (aab)$$
$$3_{ln} + 1_{hn} + 1_{ln} + 3_n : \mathbf{3}_h \quad (aba = aab)$$
$$3_{ln} + \mathbf{1}_h > 1_l + 3_n : 3_{hn} \quad (abb)$$
$$\mathbf{3}_l + 1_{hn} < 1_{ln} + 3_n : 3_{hn} \quad (abc = aab)$$
$$2_{hn} + 3_{ln} = 1_{ln} + 4_n : \mathbf{3}_h \quad (bba = aab)$$
$$2_h + 3_{ln} > 1_l + 4_n : 3_{hn} \quad (bbb)$$
$$2_{hn} + \mathbf{3}_l < 1_{ln} + 4_n : 3_{hn} \quad (bbc = aab)$$
$$1_{xh} > 1_n \quad (aaaa)$$
$$1_{hn} = 1_{hn} : \mathbf{1}_h \quad (aaba)$$
$$\mathbf{1}_h > 1_{hn} : 1_{hn} \quad (aabb)$$
$$1_{hn} = 1_n : \mathbf{1}_l \quad (abba)$$
$$\mathbf{1}_h > 1_n : 1_{ln} \quad (abbb)$$
$$1_{hn} = 1_{hn} : \mathbf{1}_l \quad (bbba)$$
$$\mathbf{1}_h > 1_{hn} : 1_{ln} \quad (bbbb)$$

"I might add, Noah, that the series following (a) give the solution for 12 weights in 3 weighings."

"And I can add, Sy, that the general solution for n weighings is given by

$$2\left[\frac{13}{54} \cdot 3^n\right]$$

where the brackets mean 'largest integer in.'

"Our new problem will be simple for highway engineers, but a tussle for the rest of you. The old highway, to be abandoned, runs from Aville 10 miles east to Burg and thence 10 miles north to Copolis. Origin and destination counts show the following daily traffic: 1,000 vehicles from Aville to Burg, 2,000 from Burg to Copolis and 3,000 from Aville to Copolis. The new highway is to be a net of three radials from a traffic circle to the three cities. Locate the traffic circle so as to minimize the aggregate mileage of all traffic."

[There were no Cal Klaters. Guest Professor Ford is Allan M. Newman. Delayed mail from Canada had one more solution to the August bike problem—from A. Masc (J. S. Kendrick).]

Claims Perpetual Motion Machine Reverses Itself

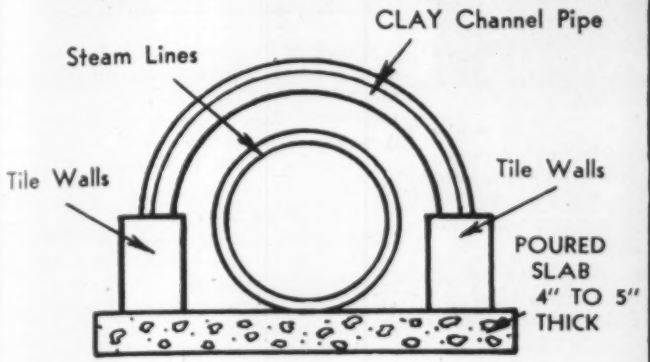
HAVING REVIEWED the design for a perpetual motion machine on page 60 of CIVIL ENGINEERING for September 1947, I have reached the conclusion that the excess power generated is being drawn on as a moving force.

Exhaustive analysis shows that not all of the features of the machine have been utilized. It can be shown that the machine will run just as readily in reverse—a precisely logical conclusion. In fact, the machine may be intended to run in reverse, which is also a precise conclusion leading to revolutionary events.

If a critical examination is made of the design and accompanying description, one finds flexible membranes which quite likely obey Hooke's law (if not, no matter—just consider them disobedient). As these membranes deflect, they admit a greater weight of water into the cans and the added water weight causes a further deflection or deformation, thus admitting more water weight and so on, ad infinitum (in other words perpetually), whence comes a perpetually increasing force producing the the perpetual motion.

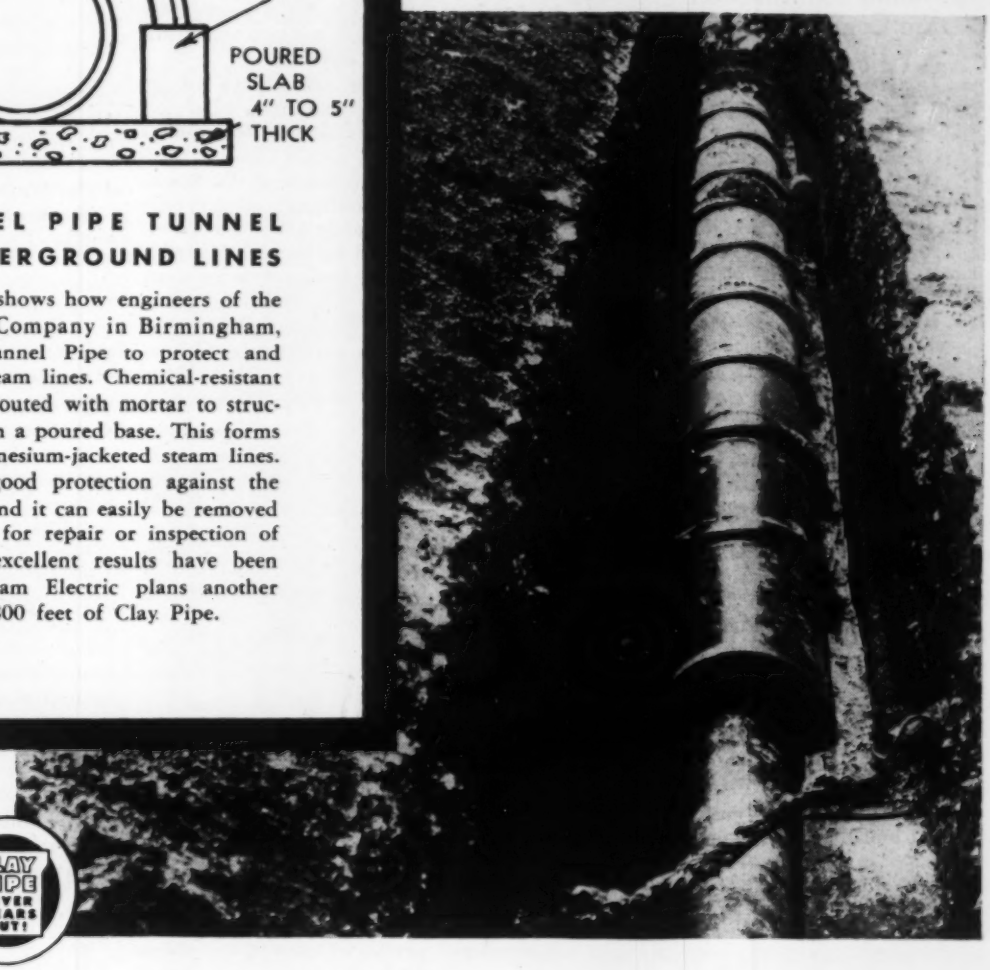
But the direction of motion thus generated is counter-clockwise to the viewer instead of clockwise as indicated by the arrows of the diagram. Obviously the sketch is a deliberate attempt to conceal the true operation of the machine for the purpose of confusing the reader. One possible purpose for such falsification is a desire on the part of public utilities and fuel

ENGINEERS DISCOVER NEW USES FOR CLAY PIPE



CLAY CHANNEL PIPE TUNNEL PROTECTS UNDERGROUND LINES

Cross-sectional diagram shows how engineers of the Birmingham Electric Company in Birmingham, Alabama use Clay Channel Pipe to protect and insulate underground steam lines. Chemical-resistant Clay Channel Pipe is grouted with mortar to structural tile sidewalls set on a poured base. This forms a "tunnel" for the magnesium-jacketed steam lines. The Clay Pipe offers good protection against the dampness of the earth, and it can easily be removed to provide quick access for repair or inspection of the steam lines. Such excellent results have been obtained that Birmingham Electric plans another similar installation of 2800 feet of Clay Pipe.



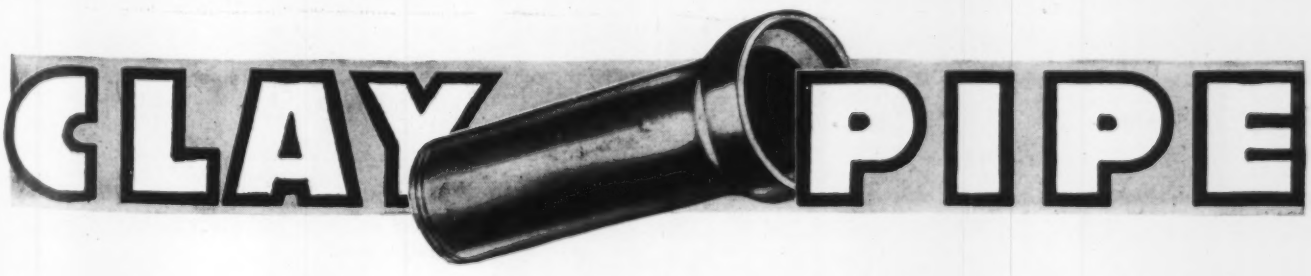
CLAY PIPE NEVER WEARS OUT!

THE same durability and corrosion-resistance that have made Clay Pipe the traditional material for all types of sewerage installations is winning wide approval in solving new and different problems. Engineers find Clay Pipe ideal insulation and protection for underground steam lines. Also, Clay Pipe is being used throughout the chemical industry to carry fluids that would soon destroy most other pipes. Clay Pipe is an economical and durable material for ducts that carry off strong industrial fumes. Clay Pipe is especially useful for drainage of modern highways and airports where heavy loads must be supported safely. For information about your Clay Pipe problems, write to the nearest regional office listed below.

NATIONAL CLAY PIPE MANUFACTURERS, INC.

111 W. Washington St., Chicago 2, Ill.
522 First National Bank Bldg., Atlanta 3, Ga.
1105 Huntington Bank Bldg., Columbus 15, Ohio
703 Ninth & Hill Bldg., Los Angeles 15, Calif.

C-947-4



producers to maintain a high market price for power and fuel. Another possible solution for the paradoxical motion is that everyone connected with the project, including the draftsman, might have become dizzy through contemplating its possibilities.

BENJAMIN EISNER, *Chief Engineer,*
Clay Sewer Pipe Association, Inc.
Columbus, Ohio

Says Action and Reaction Are Confused in Discussion

I BELIEVE Chief Engineer Eisner has confused action and reaction in the analysis of the power obtained from my machine illustrated in the September issue of CIVIL ENGINEERING, page 60. It is like a left-handed top; it will turn in one direction only.

I refer you to my article in the June issue of CIVIL ENGINEERING, page 70, for a discussion of this rather common error. Even in the case of a rod under simple tension, it takes an expert to decide whether it is the action or the reaction that breaks the rod.

The idea of the stretch of the membrane is a very important source of power but only under peak loads. At other times it can be ignored. Mr. Eisner's solution is clear and logical—the same type of reasoning used in the "Hare and Tortoise" problem and later in the "Moment Distribution Method." It is a real contribution to a difficult subject.

Yours with LXXX
Anne (*J. Charles Rathbun*)

Steel Exports in 1946 Show Trend Above Prewar Levels

EXPORTS OF STEEL and steel products from the United States in 1946, amounting to almost 11 million tons, were the lowest since 1940 but above the prewar average, according to an analysis by the American Iron and Steel Institute of a recent Department of Commerce estimate of domestic and foreign shipments by both steel producers and other distributors. These exports consisted of: finished and semi-finished steel, 4,747,397 tons; steel and iron products (including pig iron, ferro alloys and some fabricated products), 5,030,656 tons; flat rolled steel (black steel and galvanized sheets and hot and cold strip), 709,530 tons; and pipes, tubes and fittings, 458,540 tons.

New York State Construction Employment Shows Increase

CONSTRUCTION EMPLOYMENT in New York State increased from 177,500 workers in June to 187,900 in July 1947, according to a recent announcement by the executive director of the Division of Placement and Unemployment Insurance of the New York State Department of Labor.

The largest monthly increase was reported by general building contractors who construct residences and industrial farm and public buildings. Employment in this field increased from 50,800 in June to 54,700 in July, a gain of 7.7 percent.

Wool Gatherings by WOOLLEY

DR. HANS AHLMANN, professor of geography at the University of Stockholm, Sweden, reports that Arctic air temperatures have risen 10 deg F since 1900 and the ocean near Spitsbergen has risen 5 deg in temperature and several inches in level.

A NEW INSULATING MATERIAL for the walls of houses works by reflecting rather than just stopping heat rays. It is super-thin metal foil.

A NEW TINY LAMP 2 in. long and the diameter of a lead pencil, produces maximum brilliance of 9 million candle power per sq. in. Special reflectors step up its peak beam intensity to $3\frac{1}{2}$ billion candle power—enough to pierce 1,000 ft of the thickest fog.

THE LOS ANGELES BOARD of Water and Power Commissioners has authorized immediate development of hydroelectric power resources along the Owens River Gorge at a cost of $40,500,000.

"COMPREHENSIVE DEVELOPMENT" of the Colorado River basin has been shelved temporarily because of continued disagreement among area states.

BECAUSE OF SCARCITY of petroleum fuels, Soviet scientists have been experimenting with electrically driven tractors for farm use.

A FABULOUSLY RICH oil field lies under the waters of Lake Maracaibo in western Venezuela.

FOUR MILLION new street lights will be needed within 10 years for safe night driving.

ONE WINTER the George Washington Bridge across the Hudson at New York rose 3 ft at the center of the main span owing to shortening of the cables by a temperature of 14 deg below zero.

ABOUT 9,000 COMMUNITIES with a total population of over 25,000,000 in the United States have public water works supplies wholly or chiefly from groundwater sources.

EXPERTS SAY that around $2,240,000,000 a year will be needed by 1957 for research and development.

RUSSIANS HAVE BOASTED of a five-year program to turn out 700,000 engineers and scientists.

SCIENTISTS ESTIMATE there are about 30,000 earth tremors annually.

FROM JANUARY 1, 1946, down to May 1, 1947, 191,000,000 bbl of petroleum products, including 56,000,000 bbl of gasoline, were exported from the United States to foreign countries.

CRUDE OIL output is 700,000 bbl a day under demand.

THE BRITISH GOVERMENT has given electric power plants first call on the nation's annual steel ouput of about 13,000,000 tons.

A NEW WEATHER BUREAU service gives businessmen a map showing the possibilities on the weather. It was developed during the war and used in planning activities of the armed forces.

Meetings and Conferences

American Petroleum Institute. A list of distinguished speakers, headed by Secretary of the Interior J. A. Krug, is scheduled to address the 27th annual meeting of the American Petroleum Institute, to be held at the Stevens Hotel in Chicago, November 10–13.

Chamber of Commerce of the United States. The Construction Civic Development Department of the Chamber of Commerce of the United States will meet in the Chamber building in Washington, D.C., on November 19 and 20 in conjunction with the fall meeting of the Construction Industry Advisory Council.

Engineers Society of Western Pennsylvania. Papers on water treatment and supply will be presented at the Eighth Annual Water Conference of the Engineers' Society of Western Pennsylvania, which will take place at the William Penn Hotel, Pittsburgh, Pa., November 12–14.

Highway Research Board. Many important phases of highway technical development will be discussed at the 27th Annual Meeting of the Highway Research Board, which has been scheduled for December 2–5. The meeting place will be the building of the National Academy of Sciences and National Research Council, 2101 Constitution Avenue, Washington, D.C.

Society for Experimental Stress Analysis. A three-day program on the techniques of stress measurement will comprise the annual meeting of the Society for Experimental Stress Analysis, to be held in the Hotel Pennsylvania, New York, N.Y., December 4–6. Inquiries should be addressed to the Society for Experimental Stress Analysis, Box 168, Cambridge, Mass.

The Society of Naval Architects and Marine Engineers. A wide variety of problems arising in the design and construction of ships is scheduled for discussion at the 55th Annual Meeting of the Society of Naval Architects and Marine Engineers, which will take place at the Waldorf-Astoria, New York, N.Y., November 12–15.

Railroad Construction Costs Reach All-Time High in 1946

RAILROADS OF THE UNITED STATES paid out $2,231,707,000 in 1946 for fuel, materials, supplies and equipment, the largest outlay in 23 years. The composite index for 1946 covering roadway and equipment was 232 as against 209 in 1945 according to "Railroad Construction Indices" issued by the Engineering Section of the Interstate Commerce Commission's Bureau of Valuation.

This index figure marks the highest level in the history of railroad indices which go back to the 1910–1914 level of 100. The average for the year 1946, however, does not represent the peak price level attained in the postwar period, as prices in the first part of that year were materially lower than in the latter part.

NOW...NO WATER SUPPLY JOB TOO SMALL... OR TOO LARGE!

With the establishment of its new permanent pressure pipe plant in Wharton, N. J., Lock Joint Pipe Company is now able to supply pressure pipe in any desired quantity and in a larger range of diameters than heretofore.

The Wharton Plant, specializing in Lock Joint Prestressed Concrete Cylinder Pipe, is equipped to produce pressure pipe in all standard diameters from 16" up, and for all pressures common to American water works practice.

* * *

Prompt delivery can be effected by truck for short hauls direct to the installation site, or by rail to more distant localities.

SCOPE OF SERVICES — Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

LOCK JOINT PERMANENT PRESSURE PIPE PLANT AT WHARTON, N. J.

LOCK JOINT PIPE COMPANY

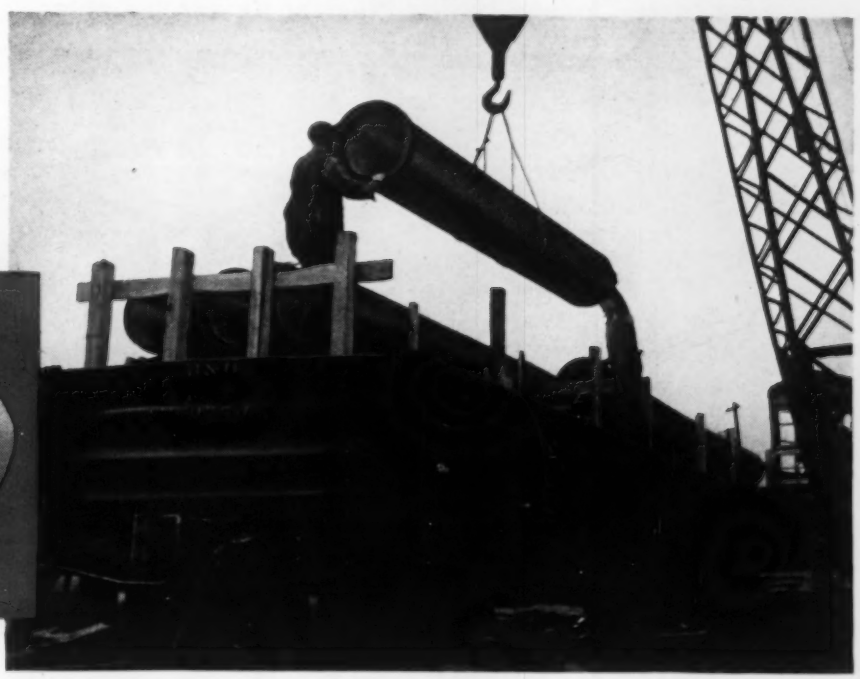
Established 1905

BOX 269 — EAST ORANGE, N. J.

Pressure Pipe Plant, Wharton, N. J.
Sewer Pipe Plant, Kenilworth, N. J.

BRANCH OFFICES: Denver, Colo. • Kansas City, Mo. • Chicago, Ill. • Rock Island, Ill. Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

LOADING PIPE IN RAILROAD CARS AT WHARTON PLANT



LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

NEW IN Education

HIGH SCHOOL STUDENTS attracted to engineering as a career will have facts to guide them to a wise decision as the result of a recent activity of the Committee on Student Selection and Guidance of the Engineers Council for Professional Development. Under the chairmanship of Prof. Carl J. Eckhardt, Jr., of the University of Texas, the committee is distributing to high schools in the United States and Canada 10,000 copies of the attractive broadside, "Engineering as a Career." The large illustrated sheet gives basic facts about the profession set forth in such a way as to be easily understood by high school students. Well-prepared questions for the student to ask himself throw light on his real aims, scholastic aptitudes, and capacity for meticulous work, enabling him to decide whether or not he will derive satisfaction from engineering work and be likely to succeed in it. Single copies of the broadside may be obtained on request from the Secretary, Engineers Council for Professional Development, 29 West 39th St., New York 18, N.Y.

MANUFACTURERS OF Diesel engine parts and accessories have joined forces with the makers of Diesel engines in a five-year educational program designed to help colleges and universities turn out a better informed engineer in this field, according to the Diesel Engine Manufacturers Association. Manufacturers have entertained visiting college instructors so that they could see first hand the latest processes, research projects, and educational aids.

MIT Makes Basic Changes in Civil Engineering Curriculum

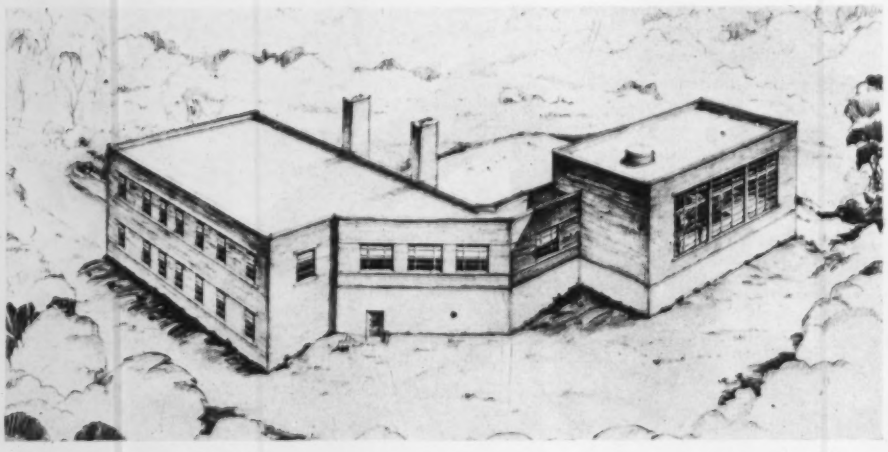
FUNDAMENTAL CHANGES in the civil engineering curriculum, constituting a major advance in engineering education, have been put into effect this fall by the Massachusetts Institute of Technology, according to Dr. Thomas K. Sherwood, dean of engineering. During the exhaustive two-year study which preceded adoption of the new program, Dr. John B. Wilbur, M. ASCE, head of the department of civil and sanitary engineering, had the counsel of a number of the country's leading civil engineers.

The new curriculum recognizes the three phases of conception, design and construction involved in every civil engineering project. All civil engineering students will take basic subjects in the humanities, mathematics, science, mechanics and surveying until the middle of the third year, when each may elect one of the following options:

1. Planning and administration, which also serves as a general course in civil engineering, including public works.
2. Theory and design which prepares men of outstanding technical promise for design, research, teaching, and graduate work in either civil or sanitary engineering.
3. Construction and management, which prepares for the supervision of all engineering construction and for contracting.

The functional approach makes it possible to offer important subjects not previously included in the curriculum. For example, students in the planning and administration option will study principles of conservation, urban sociology, and planning legislation and administration. The theory and design option includes advanced work in fluid mechanics, soil mechanics and structural theory, and the construction and management option offers courses in accounting, contract law, and business management.

Iowa State College Builds Nuclear Research Center



BUILDING in northwest corner of Iowa State College campus is planned to house 70,000,000 electron volt synchrotron of Institute of Atomic Research. Site of building, in 200-acre tract of recreation area, permits freedom of operation and facilitates power supply. In addition to synchrotron, building contains offices and laboratories for use by departments of physics, chemistry and electrical engineering in conduct of nuclear studies and research in electronics. Synchrotron, which somewhat resembles cyclotron, involves 8-ton a-c magnet provided with evacuated glass "donut" in which electrons from electron gun are accelerated to energy of 70,000,000 volts, striking target to produce narrow beam of high energy X-rays.

NEWS OF Engineers

John H. Melvin has been appointed state geologist of Ohio, with headquarters at Columbus. A former executive of the Pennsylvania Drilling Co., Mr. Melvin has for the past year been district geologist for the Army Corps of Engineers at Omaha, Nebr.

George B. Stevens has resigned as project engineer for the Raymond Concrete Pile Co. to accept a commission in the Regular Army Corps of Engineers. He returns to duty with the rank of major, and has been assigned to the Engineer Section of the Caribbean Defense Command in the Panama Canal Zone. During the war, Major Stevens served at the Stilwell Road headquarters in Burma, rising to the rank of lieutenant colonel before his release from active duty in March 1946.

Lynn Ray Cavendish, a veteran of 27 years experience in West Virginia highway construction and maintenance, will head the State Road Commission. Mr. Cavendish's most recent assignment with the Commission has been that of state maintenance engineer.

Hubert E. Snyder is now managing director of the Toncan Culvert Manufacturers' Association, with offices in Cleveland, Ohio. Mr. Snyder served in both World Wars, retiring from the army two years ago with the rank of colonel. Since then he has been connected with the Penn Metal Corp., Philadelphia, Pa.

Cleves H. Howell retired on September 1 from his position as construction engineer for the U.S. Bureau of Reclamation. His long engineering career includes experience as construction engineer on the Continental Divide (Alva B. Adams) Tunnel and as project engineer on the Colorado-Big Thompson Project. Mr. Howell's address will be 1241 Third Avenue, Longmont, Colo.

Irving A. Denison is the new chief of the Underground Corrosion Section of the National Bureau of Standards.

Alfred R. Golze, who is on the staff of the U.S. Bureau of Reclamation, has been appointed acting director of the Bureau's new Office of Programs and Finance. His title will be temporary, pending Civil Service confirmation of his appointment as director by the Commissioner of Reclamation. Mr. Golze was former assistant director of the Branch of Operation and Maintenance.

Thomas C. Moorshead, after 28 years in England, has retired and moved to 6101 Vista de la Mesa, La Jolla, Calif. Mr. Moorshead went to England in 1918 to build plants for the United Glass Bottle Manufacturers, Ltd., and remained as chief engineer and managing director of the organization.

Cantilevers and Tubular Columns Make Possible Unusual Design

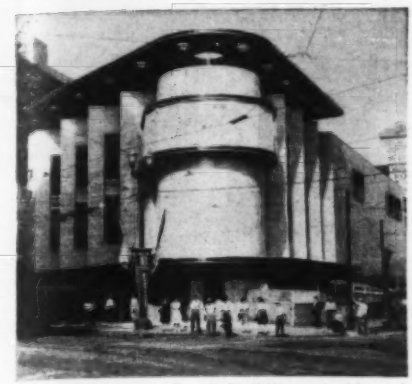


Fig. 1. The new Bond Building. Architect is Walker & Weeks, Cleveland.

By William B. Miller, C. E.
Cleveland, Ohio

THE architectural design of the new Bond Building (Fig. 1), erected on a downtown corner in Cleveland, makes use of cantilevers and some tubular columns. Arc welding was called upon frequently in fabricating the unusual structural forms.

A continuous, saw-tooth ground floor show window plan extends, unobstructed by any exterior columns, around both street sides, over which is a continuous marquee. The marquee and exterior portion of the 3-story building are supported by means of cantilevers from the main interior columns.

Fig. 2 is a sectional sketch of the cantilever construction over the show window. The 18″ x 20″ plates connecting the hanger and the wind bracing (labeled "A" in the sketch) were position welded in the fabricating shop, and the angle hangers were field welded to this plate with ⅜″ fillet welds after the marquee cantilevers were aligned. "Fleetweld 5" electrode was used for all welding on this job.

To give the marquee a slight upward slant (exaggerated in Fig. 2), the main marquee cantilever beams were bent in the shop by flame-cutting part-way through at point "B", bending, then welding the triangular gap, reinforcing the bottom flange with a welded splice plate. The top flange was not cut in order to facilitate fabrication.

As can be seen in Fig. 1, the corner of the building above the marquee line is rounded and extends over the main entrance. Tubular columns are used in this rounded corner to facilitate fabrication of beams framing radially and tangently into the columns. Fig. 3 is a portion of the corner bay on the third floor, showing radial cantilever beams which are shop-fabricated by coping out, bending and welding.

Fig. 3. Cantilever beams in corner bay at third floor level.

Fig. 4. Welding soffit plates of the canopy.

The clean-cut lines of the marquee and the decorative canopy over the top of the building were made possible by arc welded fabrication. The canopy frame is constructed entirely of steel using 10″ I beams of various weights to give a flush surface top and bottom. Top plates ¼″ thick and soffit plates 3/16″ thick were attached to this frame by welding. The soffit plates, erected first, were tightly clipped to the I beam flanges with stud-welded clips, then arc welded to the flange from above (Fig. 4).

After the soffit plates were completely welded, the deck plates were positioned, tack welded and continuously welded to the I beams, the weld metal filling in the ¼″ gap between plates and making a watertight job. The joints between the soffit plates were then welded continuously (Fig. 5). The welds were ground to a smooth flush surface. The open rings in the canopy were shop-fabricated by forming ⅜″ plate into a cylinder and fillet welding it to cut-out top and bottom plates.

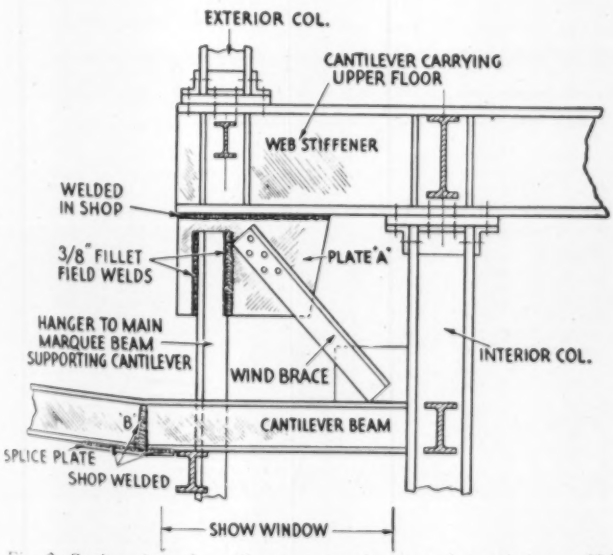


Fig. 2. Section view of cantilever construction over show windows which supports marquee and exterior columns for upper floors.

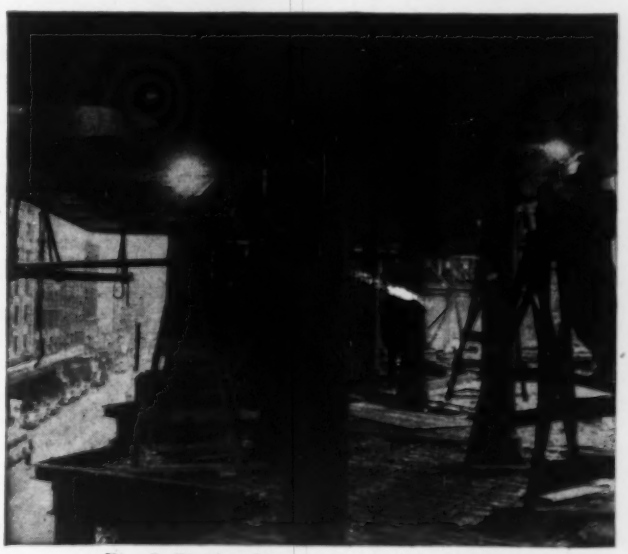
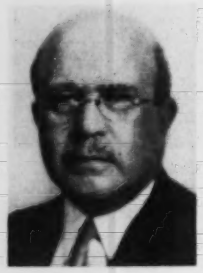


Fig. 5. Finish-welding underside of the canopy.

The above is published by LINCOLN ELECTRIC in the interests of progress. Structural Design Studies are available free to architects and engineers. Write The Lincoln Electric Company, Dept. 275, Cleveland 1, Ohio.

Theodore W. Norcross, since 1920 chief of the engineering division of the U.S. Forest Service, will retire at the end of the year. Mr. Norcross' first assignment with the Forest Service was that of regional engineer at Denver, where he had charge of water power, irrigation and water supply projects in the national forests of ten states. Transferred to Washington as assistant chief engineer in 1913, he became chief engineer seven years later. Mr. Norcross will



U.S. Forest Service

T. W. Norcross

U.S. Forest Service

Anthony P. Dean

be succeeded by **Anthony P. Dean,** since 1939 assistant regional forester in charge of engineering for the California national forests, with headquarters in San Francisco.

C. Louis Meyer, founder and former president of Ceco Steel Products Corp., Chicago, Ill., has been named to the new position of chairman of the board. He will be succeeded as president by **Ned A. Ochiltree,** formerly executive vice-president.

Lt. Col. Helmer A. Holmstrom, of St. Paul, Minn., recently took command of the 8th Engineer Squadron, famous unit of the 1st Cavalry Division, at Camp Drake, Tokyo, Japan. A reserve officer from 1932 to 1946, Colonel Holmstrom has been on active duty since March 1941, and saw service overseas with the Sixth Army. He was commissioned in the Regular Army Corps of Engineers in July 1946.

D. Allan Firmage has resigned as civil engineer for the Engineer Board at Fort Belvoir, Va., to accept the position of assistant professor of civil engineering at the University of Florida.

Carroll A. Farwell and **Arthur D. Weston** have been elected to the Board of Governors of the Boston City Club. Mr. Farwell is a partner in the Boston engineering firm of Fay, Spofford & Thorndike, and Mr. Weston chief engineer for the Massachusetts Department of Public Health.

William F. Tompkins, retired major general in the Army Corps of Engineers, has accepted the position of comptroller of the Medical College of Virginia, Richmond, Va. As comptroller, he will be in charge of the budget and all financial operations of the college, and will also supervise purchases and services and personnel.

Arthur E. W. Dodds is opening a consulting office in Seattle, Wash., where he will specialize in engineering and architectural work on residential, commercial and industrial construction. Mr. Dodds was previously chief engineer of the engineering sales division of the Weyerhaeuser Sales Co., Tacoma, Wash.

Delbert B. Freeman, lieutenant colonel in the Army Corps of Engineers, has been transferred from the U.S. Engineer Office at Omaha, Nebr., to the Far East command at Yokohama, Japan.

Russell C. Brinker has severed his connection as associate professor of civil engineering at the University of Minnesota to take a position in a similar capacity at the University of Southern California, Los Angeles.

Simeon Ross is now president of the Eureka Concrete Corp., Brooklyn (N.Y.) engineering and contracting organization. Mr. Ross was previously chief engineer of the Del Balso Construction Corp., Brooklyn.

Benjamin F. Rush, until lately public works superintendent of the territory of Hawaii, has accepted the newly created post of director of harbor facilities. In his new capacity he will direct a large harbor improvement program, authorized by the Hawaiian legislature.

Col. Herman H. Pohl, of the Army Corps of Engineers, was recently assigned to duty as district engineer at Wilmington, N.C. He was formerly in the personnel division of the Office of the Chief of Engineers, Washington, D.C.

Raymond F. Goudey, until lately principal sanitary engineer for the Los Angeles Department of Water and Power, has accepted a position with Truesdail Laboratories, Inc., Los Angeles chemists and bacteriologists. He will direct the activities of the organization's new sanitary engineering division. A recipient of the John M. Goodell Prize and the George Warren Fuller Award of the American Water Works Association for outstanding achievement in the field of sanitary engineering, Mr. Goudey is on the executive committee of the ASCE Sanitary Engineering Division.

William J. Eney, professor of civil engineering at Lehigh University, was recently named head of the department and director of the civil engineering curriculum. He succeeds **Hale Sutherland,** who asked to be relieved of his administrative duties in order to have more time for his professional writing. Mr. Hale will continue as professor of civil engineering.

Robert B. Richardson has assumed new duties as acting director of highways for the State of Louisiana, succeeding **Col. P. A. Frye,** whose resignation was effective September 15. Mr. Richardson has been in the Department of Highways for 26 years—as instrumentman, resident engineer, district engineer at Monroe, and chief construction engineer. Since 1940 he has been construction and maintenance engineer. His headquarters will be in Baton Rouge.

R. B. Richardson

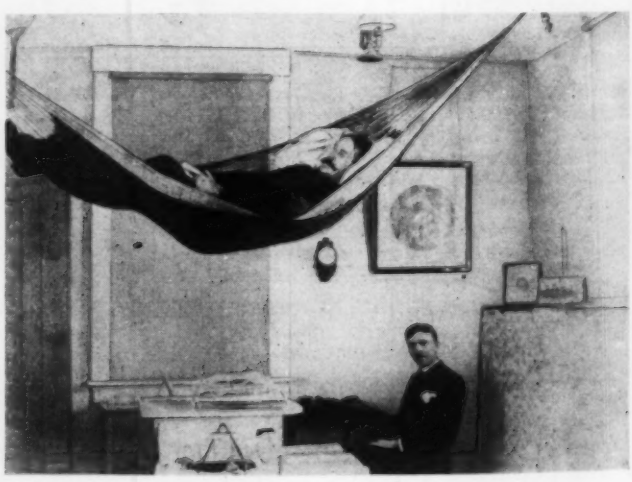
R. S. Green has been appointed editor-in-chief of the James F. Lincoln Arc Welding Foundation's new book, *Design for Welding,* which will be based on the outstanding papers submitted in the Foundation's recent Design-for-Progress Award Program. Professor Green is in the department of industrial engineering at Ohio State University.

Theodore Human, Jr., has been awarded the Meritorious Civilian Service Award of the War Department for distinguished wartime service under the Miami District and the Pan-American Division. At present Mr. Human is senior highway engineer for the Pacific Islands Engineers in Guam.

Kirby Smith and **Albert E. Cummings** have been elected directors of the Raymond Concrete Pile Co., New York, N.Y., filling the vacancies created by the resignation of **Elihu D. Watt** and the death of **Robert A. McMenimen.** Mr. Smith is vice-president of the organization, and Mr. Cummings research engineer.

Wesley B. Thompson has resigned as senior engineer for the Boston consulting firm of Fay, Spofford & Thorndike to open an office for the private practice of civil and structural engineering at 7 Water Street, Boston, Mass. During the war Mr. Thompson was employed by the Woods Hole (Mass.) Oceanographic Institution on a research program for the Navy.

FLASHBACK to old days (eighteen eighties) when students at Thayer School, Dartmouth College, were allowed to room in Observatory in return for keeping daily weather records, shows two ASCE members in undergraduate days. In hammock is C. F. Chase, who died in 1945 after long engineering career in New Britain, Conn. Seated student is F. B. Sanborn, now chairman of Sanborn Co., Cambridge, Mass.



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The "Big Store" is an American institution, where a man can get a better buy from a broader choice. That's why most buyers go to a Fairbanks-Morse-Pomona dealer for their vertical turbine pumps.
They know that these dealers are not restricted in their recommendations. They know that they'll get impartial help in buying the right pump.
For instance, Fairbanks-Morse offers a choice of oil or water lubrication, open or closed impellers. This is greater surety of getting skilled, unrestricted service in obtaining the pump that is most suited to your particular pumping work.
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Take advantage of the extra value in trading from the "Big Store in the pump industry"!
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Jesse C. Dietz is now assistant professor of sanitary engineering at the University of Illinois. He was previously research assistant in civil engineering at the University of Wisconsin.

David L. Sargent, formerly structural engineer for the Austin Co., Cleveland, Ohio, has become assistant professor of civil engineering at the University of Utah.

Giles G. Green, of Jamaica, N.Y., was recently appointed assistant professor of civil engineering at the Cooper Union school of engineering. An alumnus of Cooper Union, Mr. Green has done graduate work at Cornell University and Massachusetts Institute of Technology and is a specialist in structures and the mechanics of materials.

George R. White has been promoted from the position of associate structural engineer in the Division of Buildings, Buffalo, N.Y., to that of chief structural engineer.

Paul M. Zander has accepted the position of city engineer of Little Rock, Ark.

Deceased

William Benjamin Bennett (M. '12) retired engineer of Niagara Falls, N.Y., died on April 6, 1946, though word of his death has just reached the Society. He was 80. Mr. Bennett was for many years engineer for the Niagara Falls Power Co., retiring in 1941. Earlier he had been city engineer for Niagara Falls, and consulting hydraulic engineer for the Pennsylvania Water and Power Co., at Holtwood, Pa.

Francis Hewette Davis (M. '15) retired engineer of Tres Pinos, Calif., died on September 12, at the age of 78. Mr. Davis spent his early career in railroad work in the United States and Nicaragua, and later was engaged in the development of California oil fields. Beginning in 1905, he was for many years connected with the Santa Cruz Portland Cement Co., which he served as resident engineer at Davenport, Calif., and general superintendent and works manager at San Francisco.

Raymond Duerr (M. '39) superintendent of the Aspen Grove Cemetery Association, Burlington, Iowa, died on September 9, at the age of 62. Mr. Duerr had been assistant city engineer of Burlington, Iowa; county engineer for Des Moines and Van Buren counties, Iowa; and civil engineer for Near East Relief in Syria and Turkey. From 1921 on he was superintendent of the Aspen Grove Cemetery in general charge of all engineering and planning.

Vernon Milton Eager (M. '18) of Seattle, Wash., died at his home there on September 4. Mr. Eager, who was 61, had spent most of his career in the state of Washington. He had been county engineer for Pacific and Whatcom counties, city engineer for South Bend, and assistant city engineer for Bellingham. More recently he was resident office engineer for the State Highway Department at Seattle.

Frank Hooker Alfred (M. '03) former president and general manager of the Pere Marquette Railway, died at his home in Orlando, Fla., on October 6. Mr. Alfred, who was 80, began his railroad career with the Norfolk & Western Railway in 1889. With the exception of six years spent with other organizations, he was with the Pere Marquette from 1901 until his retirement in 1929. During this period he served as division engineer, chief engineer, general manager and president. In Detroit, Mich., where he made his home for many years, he was known for civic and educational activities, having been president of the Board of Education and chairman of numerous civic committees.

Frank H. Alfred

Carl Hamilton Fuller (M. '21) of Youngstown, Ohio, died at his home there on August 21, at the age of 69. From 1918 until his retirement in 1945 Mr. Fuller was a civil engineer for the Carnegie-Illinois Steel Corp. at Youngstown, engaged on power plant design and plant extensions. He was formerly chief engineer for the Cook Construction Co., Des Moines, Iowa.

George Fiske Hardy (M. '05), senior partner in the New York consulting firm of George F. Hardy & Son, died in a hospital in New York City on October 2. Mr. Hardy, who was 82, was responsible for the design of many of the leading pulp and paper mills and hydroelectric power plants in the United States, Canada and Mexico. He began his career as engineer for D. H. and A. B. Tower of Holyoke, Mass., specialists in pulp and paper mills, and later was made a junior partner in the firm. In 1898 he became chief engineer of the International Paper Co., resigning in 1901 to acquire his own business. Since 1932 Mr. Hardy was engaged chiefly in the development of the kraft pulp and paper industry in the Southern states.

Carl Hildabrand (Assoc. M. '25) civil engineer and plant operator for the Manila Electric Co., Manila, P.I., died recently at Claremont, Calif. He was 58. Mr. Hildabrand had served as resident engineer on the construction of a sewage-disposal plant for the city of Shanghai, China, and from 1925 to 1929 was superintendent of construction on the erection of Yenching University at Peking. He had been with the Manila Electric Co. since 1930, and was interned at Santo Tomas during the war.

Henry Neely Ogden (M. '09) professor emeritus of sanitary engineering at Cornell University, Ithaca, N.Y., died there on September 29. Professor Ogden, who was 79, was a member of the Cornell faculty for 49 years. He entered Cornell as a student in 1885 and began teaching in the school of civil engineering upon his graduation in 1889. He retired nine years ago. Professor Ogden served as engineer to the New York State Board of Health from 1906 to 1913, and later was a member of the State Public Health Council.

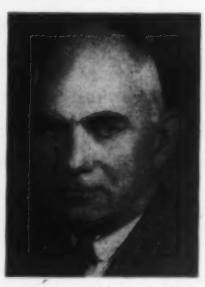
Wesley Oliver Pease (M. '30) superintendent of streets for Dayton, Ohio, died in that city on August 13. He was 58. From 1922 to 1933 Mr. Pease was county engineer for Montgomery County, Ohio. He had also been with the Ohio State Highway Department at Middletown, and for some years had an engineering practice in Dayton.

Arthur George Ready (Assoc. M. '28) of St. Mary's, Ga., died in a hospital in Savannah, Ga., on August 14. Mr. Ready, who was 51, spent his early career in New York city as resident engineer for George F. Hardy, New York consultant. Later he was resident engineer for the organization in Georgia, Louisiana, Texas and Mexico on the construction of paper mills. At the time of his death, he was consulting engineer for the National Container Corp., Jacksonville, Ga.

David Joseph Shaw (Assoc. M. '07) engineer for William Raisch, New York, N.Y., died recently. He was 72. Mr. Shaw was in the engineering service of New York City for a number of years, having been in the Bridge Department, the Department of Sanitation, and the Board of Water Supply. More recently he was deputy commissioner in the Brooklyn Building Department. At one time Mr. Shaw had a consulting practice in New York.

Earl Joseph Sherwood (Assoc. M. '28) president of the Great Lakes Pipe Co., Buffalo, N.Y., died recently. Mr. Sherwood, who was 49, had been president of the pipe company since 1929. For some years, during this period, he was also president of the District Improvement Corp., at Buffalo. Earlier in his career he had served as Buffalo district manager for the American Construction Co.

Arthur Gray Butler (M. '27) manager of engineering and construction for the Duquesne Light Co., Pittsburgh, Pa., died on September 7. He was 58. From 1918 to 1929 Mr. Butler was general superintendent of construction for the Louisville (Ky.) Gas and Electric Co., and from 1929 to 1936 manager of the Pittsburgh branch of the Bylles by Engineering and Management Corp. In the latter year he became connected with the Duquesne Light Co. Large construction projects carried out under Mr. Butler's direction included the Ohio Falls Development at Louisville, and several Pittsburgh power stations.



Arthur G. Butler

Harold Emerson Shugart (Assoc. M. '43) acoustical engineer and contractor of Los Angeles, Calif., died on August 19, at the age of 53. Mr. Shugart had been a hydraulic engineer for the Pacific Light and Power Co.; assistant to the chief engineer of the Southern California Gas Co.; and acoustical engineer for the George L. Eastman Co. For the past 15 years he had been

Built by Board of County Commissioners, Dade Co., Fla., Earle M. Rader, County Engineer. J. E. Greiner Co., Consulting Engineers.

ON THE RICKENBACKER CAUSEWAY

AGAIN Monotubes play an important part in an engineering triumph—the Rickenbacker Causeway, Miami, Fla.

1260 7-gauge Monotube tapered steel piles, 45′ long, with 18″ butt diameter, were used in the piers of the fixed-beam bridges for this project. Piles were capped at the water line.

For this job, as on so many others, Monotubes were chosen because of their time-and-money-saving advantages. *They are cold-rolled and fluted for extra strength,* resist bending forces equally well from all directions. *They're light in weight, easily handled, extendible right on the job. Tapered design speeds driving—tubular construction makes inspection easy before concreting.*

For complete information, write The Union Metal Manufacturing Co., Canton 5, Ohio.

UNION METAL

Monotube Tapered Piles

head of his own engineering and contracting business, the Harold E. Shugart Co., Los Angeles.

Frank LeRoy Flynt (Assoc. M. '30) senior hydraulic engineer for the U.S. Engineer Department at Rock Island, Ill., died on September 10. He was 62. Mr. Flynt had been assistant division engineer for the S. Louis-San Francisco Railway, and from 1924 to 1934 he was in the Sewer Design Department of the city of St. Louis, engaged in the design of relief sewers and in research in rainfall and runoff. He had been with the Rock Island District of the Corps of Engineer since 1936—for the past five years as senior hydraulic engineer in charge of the Hydraulic Section. In 1937 Mr. Flynt was co-winner, with ASCE Past-President W. W. Horner, of the Rudolph Hering Medal for a paper on "Relation Between Rainfall and Runoff from Small Urban Areas."

Frank L. Flynt

Loy E. Sneary (M. '40) engineer for J. F. Pritchard & Co., Kansas City, Mo., died on August 5, at the age of 62. Mr. Sneary was assistant city engineer of Davenport, Iowa, from 1916 to 1921; chief engineer and director of water for East Moline, Ill., from 1921 to 1923; and chief engineer of public construction at Davenport from the latter year to 1932. Later Mr. Sneary was resident engineer inspector for the Federal Works Agency in Ohio, and for a time served as director of the Kansas City (Mo.) Water Department.

Leonard Sewall Smith (M. '11) of Stockton, Calif., died on July 1, at the age of 83. Professor Smith was on the engineering staff of the University of Wisconsin for 35 years—as professor of highway engineering and city planning from 1918 until his retirement in 1928. While at the university, Professor Smith also served as engineer for the U.S. Geological Survey on a number of water supply and hydrological projects in Wisconsin, and prepared a 350-page report on the water power of the state. Secretary-treasurer of the Engineering Society of Wisconsin from 1915 to 1926, Mr. Smith played an important part in the growth of the organization.

David Pyper Thomas (Assoc. M. '41) vice-president and general manager of the Equipment Engineering Co. and a sales engineer for Western Steel Co., Salt Lake City, Utah, was killed in an automobile accident near Dubois, Idaho, on September 11. Mr. Thomas, who was 47, had been with the Utah Copper Co. and the Utah State Road Commission. A member of the Army Reserve Corps, he was called to active duty in September 1940. He served in this country and overseas in the Army of Occupation, with the rank of lieutenant colonel, and was discharged from active duty in January 1947.

Precise Specifications and Contracts Invite Lower Bids

(*Continued from page 39*)

with good advantage on many other projects.

Procedure along the lines discussed here calls for a close and cooperative relationship between the owner, the engineer or architect, and the contractor, with the objectives of the project itself constantly in the minds of all. It is believed that the required degree of cooperative relationship is not at all idealistic. Rather, the writers regard it as a thoroughly practical and realistic procedure, promising a reduction in project costs and benefits to all concerned, including the interests of the construction industry as a whole.

Advancement in Timber Mechanics and Design

(*Continued from page 43*)

Graduate Courses—Mechanics of Orthotropic Materials

For the student who is interested in continuing his education in the field of wood technology and who seeks a more detailed study of the relationship between the stresses and strains in wood and plywood and the exact derivation of the formulas used in wood and plywood design, a course outlined as follows is offered at the University of Florida:

- A. Wood as an Orthotropic Material
- B. Plane Stress and Plane Strain in Wood and Plywood
- C. Relationship Between the Stresses and Strains in Three Dimensions
- D. Components of Stress and Strain on Axes Inclined to the Orthotropic Axes
  - 1. Mathematical
  - 2. Graphical
- E. Stress Function
- F. Practical Applications
- G. Relationship Between Theoretical Equations and Test Results on Wood and Plywood

Conclusions

Since technical developments in the past 15 years have made it possible to design in wood and plywood with the same degree of accuracy and efficiency as in other materials, it is felt that unless the student is given adequate instruction in these materials the educators of today are neglecting their responsibility. The suggested method of instruction is probably not the ideal one, but it is firmly believed that the student should start his education in this field along with that in other materials, and the logical place seems to be in his first course on the strength of materials.

Wood has reached a place of prominence in the construction industry and it will continue to be an important structural material. How, then, can we neglect to give it proper space in our engineering curricula today?

Building Research Advisory Board Promotes Development

(*Continued from page 47*)

the field of heavy construction. So many engineers are interested only in the latter field that they may properly wonder what is being done about it. This may well be the subject of later discussion, and their views will be welcome.

Since the Board is not actually in operation as yet, there is time to extend the scope of its operations if this is considered necessary or desirable. All branches of the construction industry will soon be called on to examine the revised prospectus of the new Board, and in order that proper comment and suggestions may be made it would be helpful to have the membership's reaction as early as practicable. Comments regarding the membership of the Board or its aims, objectives and mode of operation will be welcomed by the writer. Opinions are sought on questions such as: Should this research activity be limited to materials and methods, or should it be extended to include the social or economic problems which greatly influence high-quality low-cost construction, such as labor, public relations, contracting, financing, code phases, and the like?

Simplified Designs Facilitate Pitot Tube Application

(*Continued from page 48*)

essentially every length of pipe in the laboratory with taps capable of utilizing the simplified instruments. As 10-gage metal (approximately $^1/_8$ in. thick) is rather light for a satisfactory depth of $^1/_8$-in. tapered pipe threads, the wall will be reinforced with a small patch of $^1/_8$-in. yellow brass, soldered to the outer face of the pipe at each tap location.

When not in use, these tapped holes will be plugged with standard brass pipe plugs. It is believed that the result of this program will be to achieve much more satisfactory instrumentation at a considerably smaller cost than that required for an adequate installation of wall piezometers.

ROOFING and SIDING . . .

HERE ARE THE DETAILS

Thickness: .032 inch.

Lengths: 5, 6, 7, 8, 9, 10, 11 and 12 feet.

Widths: Roofing sheet, 35 inches; Siding sheet, 33¾ inches; Coverage: 32 inches.

Corrugation: ⅞ inch deep, 2.67 inches crown to crown.

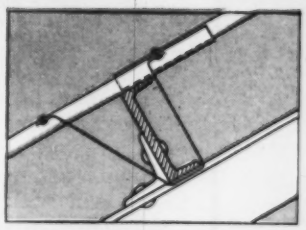
Weight: 56 lbs. per 100 sq. ft.

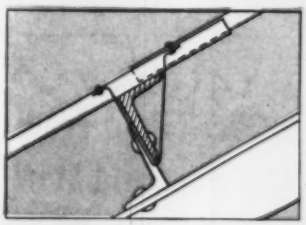
LOAD CARRYING CAPACITY

PURLIN SPACING	CLEAR SPAN	UNIFORM LOAD p. s. f. (Safety Factor: 2)
6'6"	76"	29
6'0"	70"	35
5'6"	64"	41
5'0"	58"	50
4'6"	52"	63
4'0"	46"	80

QUICK APPLICATION

Illustrated here are two of the many ways of installing Alcoa Industrial Roofing Sheet.



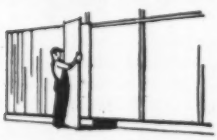


STRAP FASTENERS CAN BE ADAPTED TO PRACTICALLY ANY TYPE OR ARRANGEMENT OF PURLINS.

WITHSTANDS INDUSTRIAL SMOKE AND FUME

Alcoa Aluminum has been used for many years on coal mines, railroad terminals, warehouses, factory buildings and locomotive roundhouses. The protective qualities of Alcoa Roofing and Siding have been virtually unaffected by these severe conditions.

FOR SIDING THAT GOES UP FAST



Alcoa Industrial Siding has the same corrugation dimensions and lengths as Industrial Roofing. Over-all width is 33¾ inches covering 32 inches and providing extra economy for siding applications. Properly applied and with girt spacings up to 7'9" it will withstand 20 p.s.f. wind load.

ASK FOR COMPLETE INFORMATION

Pick up your telephone now and call your local Alcoa sales office. Ask for a sample and complete information on Alcoa Industrial Roofing and Siding Sheet. Or write to ALUMINUM COMPANY OF AMERICA, 1447 Gulf Bldg., Pittsburgh 19, Pa.

INDUSTRIAL ROOFING AND SIDING

Federal-Aid System Provides Network of Arterial Routes

(*Continued from page 19*)

each map marked in accordance with the attached sample, to show:

a. Routes and lengths of existing federal-aid system extensions.
b. Routes and lengths of existing federal-aid secondary system extensions.
c. Principal lines of travel within the urban area. (Desire lines)
d. Routes and lengths of a logical interim and a logical ultimate urban federal-aid system.

Principal lines of travel should be determined as promptly as possible by metropolitan area traffic studies. In the absence of data developed by such studies, tentative decisions may be based on the best factual data available.

The extent of the mileage included in the urban federal-aid system will be determined in accordance with principles of sound highway planning and economics and without regard to any other mileage limitation. It is anticipated that the ultimate urban federal-aid system will connect with all of the federal-aid primary roads approaching a city, but that the interim system may frequently omit adequately improved connections with these routes. The interim system should be thought of as comprising the routes which are the most important routes for early programming and that will be expanded by additions from time to time to form finally an integrated transportation network as contrasted to the inclusion of scattered streets that are in early need of improvement.

There will be no objection to the inclusion of stub routes within the urban area as routes of the urban federal-aid system, provided the stub routes selected are determined to coincide with principal lines of travel within the urban area. Determination of classification of extensions of presently approved federal-aid secondary routes in urban areas will depend upon the relative importance of the route. There will be no objection to classifying a well-qualified route as part of the urban federal-aid system within urban limits, and classifying its extension into a rural area as part of the federal-aid secondary system. Neither will there be objection to termination of a federal-aid secondary route at an urban boundary. In some instances further adjustment of the urban limits may be found desirable.

In marking routes of the urban federal-aid system on the city maps, locations along specific streets will depend upon local conditions. Each line is intended to show approximate location, and only where it is evident that a new location will be removed a considerable distance from a specific street or existing extension of a federal-aid route will it be necessary to show a new line with a corresponding deletion of the old line.

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Caine CORR-PLATE Steel Piling

Rolled from a new steel alloy, Caine Corr-Plate is now 25% stronger and has nearly 100% greater corrosion resistance. This alloy makes available equal strength and nearly double the life in a 25% lighter piling. Approved by Highway Departments and U. S. Engineers.

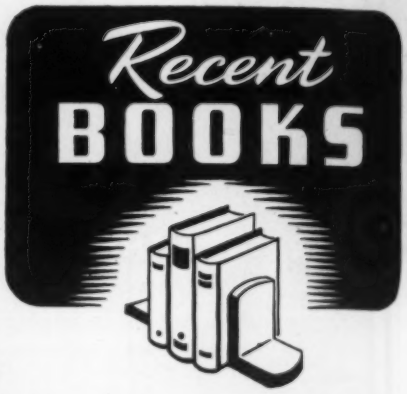
Caine Corr-Plate Steel Piling has been used the world over for Foundations, Dams, Retaining Walls, Docks, Levees, Bulkheads, Sewers, Disposal Plants and hundreds of other jobs—It's stronger, lighter, nestable, easy to drive and water tight; can be re-used again and again.

Doubled life and 25% greater strength make Caine Corr-Plate Steel Piling the bargain buy in piling!

NOW, MORE THAN EVER BEFORE...
STRONGEST PER POUND WEIGHT

CAINE STEEL COMPANY
STEEL PILING DIVISION, 1820 N. Central Avenue, Chicago 39, Illinois

2278



NATURAL PHILOSOPHY OF PHYSICS, CHEMISTRY AND ENGINEERING. Published by C. A. P. Turner, M. ASCE, 964 High St., Columbus, Ohio. 9 × 6 in., 320 pp., $6 postpaid. According to the author: "The book represents 50 years' study of thermoelasticity (see ASCE TRANSACTIONS, August 1902) and its application to engineering and chemical problems. It proves intermolecular forces are governed by Newton's law of attraction and known gas laws correlating the physical properties of the chemical elements, thus providing an actual in place of a hypothetical basis for the science of elasticity, proving that elastic resistance is stored in change of volume, that a carrying rod develops greater strength under a suddenly applied load than under gradual application, and the fact that shear strain at the support of restrained beams is now figured double the actual. It develops the dynamic theory of chemistry, thus enabling the calculation of the heat of formation of all reversible chemical compounds. It develops the cause of the tides, solves the mystery of heat vibration, gravity and electric energy and determines the radius of the earth from its siderial time of rotation."

ORGANIZATION AND MANAGEMENT IN INDUSTRY AND BUSINESS, 3 ed. By W. B. Cornell. Ronald Press Company, New York, 1947. 819 pp., illus., diagrs., charts, tables, 9¼ × 6 in., cloth, $5. Intended for use in schools of commerce and colleges of engineering, this text presents detailed information on the varied subjects included in the field. Broad in scope, the volume covers the topics of organization and operation of a business enterprise, production control, and time study. Concrete examples of problems solved for well-known manufacturers are given. For each topic discussed, details of practical value are presented.

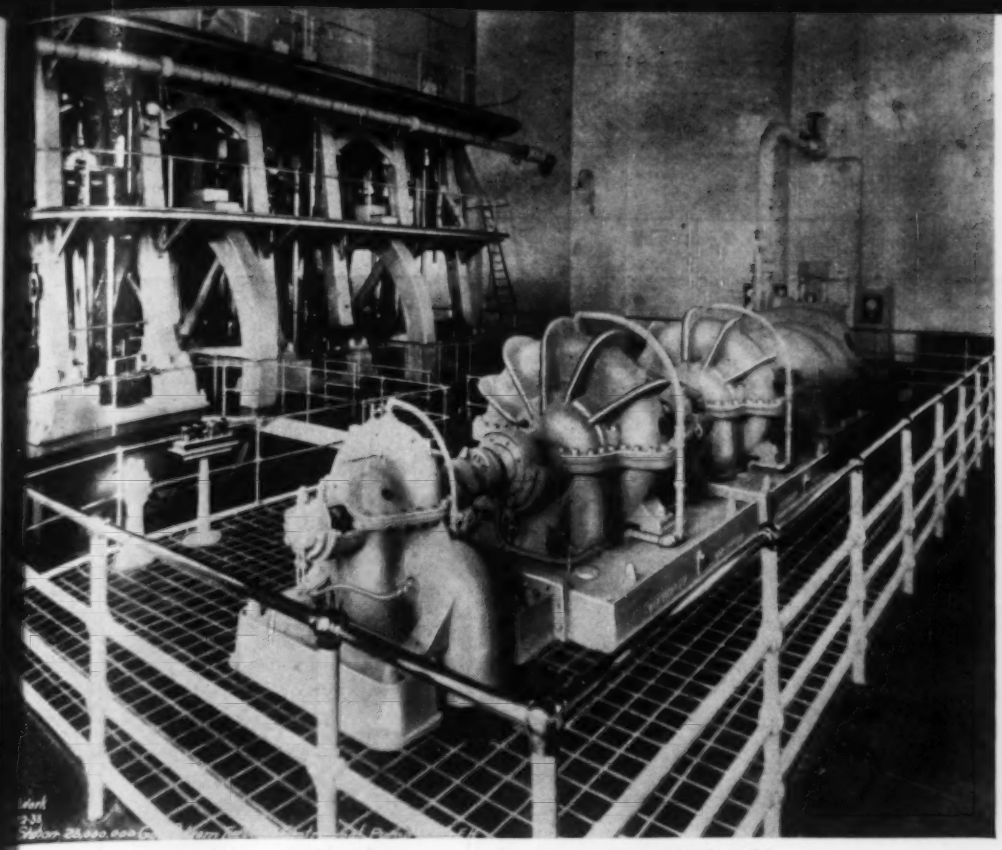
PHOTOGRAMMETRIC CONTROL EXTENSION. By R. O. Anderson. Obtainable from Edwards Brothers, Ann Arbor, Mich., 1947. 52 pp., diagrs., tables, 9 × 6 in., paper, $1. This publication, supplementary to the author's *Applied Photogrammetry*, explains the control extension process on aerial photography (for both horizontal and vertical positions) without ground measurements except at flight-ends. A complete fictitious example is constructed, and the detailed solution is carried out and checked as a numerical verification of the theory.

SIMPLIFIED ENGINEERING FOR ARCHITECTS AND BUILDERS, 2 ed. By H. Parker. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 245 pp., diagrs., charts, tables, 8 × 5 in., cloth, $3. The purpose of this volume is to supply architectural draftsmen and builders who have no training in engineering, with sufficient data to enable them to solve simple structural problems. A knowledge of arithmetic and high school algebra is required. Basic principles of forces in equilibrium are first discussed and then applied to timber, steel and reinforced concrete construction.

NEWS

FROM THE PUBLIC WORKS FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON



Worthington turbine driven pump, Cincinnati Water Works, Ohio

1 Pump—25 MGD—210 PSI Head—14 Years

e Worthington pumping unit which was talled by Cincinnati Water Works in 1934 been operating continuously ever since th scarcely any repairs.

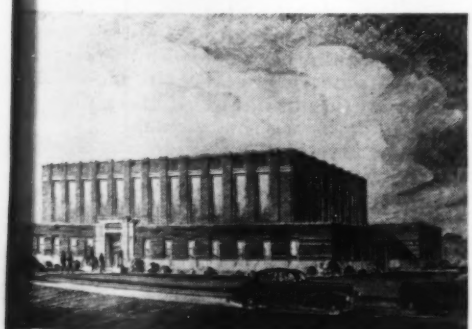
The unit has a rating of 25 million gallons day against a total head of 470 feet TDH.

The photograph of this unit provides an interesting comparison—in the foreground, the compact 25 mgd unit referred to; in the background a massive 25 mgd Worthington vertical triple expansion reciprocating engine installed over 40 years ago. The latter is one of seven such old time Worthington units still in service at this site.

Philadelphia Gets War-Delayed Pumps

iladelphia's Bureau of Water began its dernization program in 1941 with the arding of a contract to Worthington for nishing and installing new motor-driven gle and two-stage centrifugal pumping its for the Torresdale Pumping Station on the Delaware River. The contract covered the following units:

Four	40 mgd, 200 ft TDH,	1750 hp
Two	20 mgd, 200 ft TDH,	900 hp
One	6 mgd, 360 ft TDH,	500 hp
Three	3 mgd, 360 ft TDH,	250 hp



rresdale Pumping Station of Philadelphia's Bureau ter to be equipped with Worthington pumping units.

Building of the new pump house and the delivery of the pumps were delayed by the war. As a temporary measure to supply increased demand, one 6 mgd unit and two 3 mgd units were put into service in a temporary pump house.

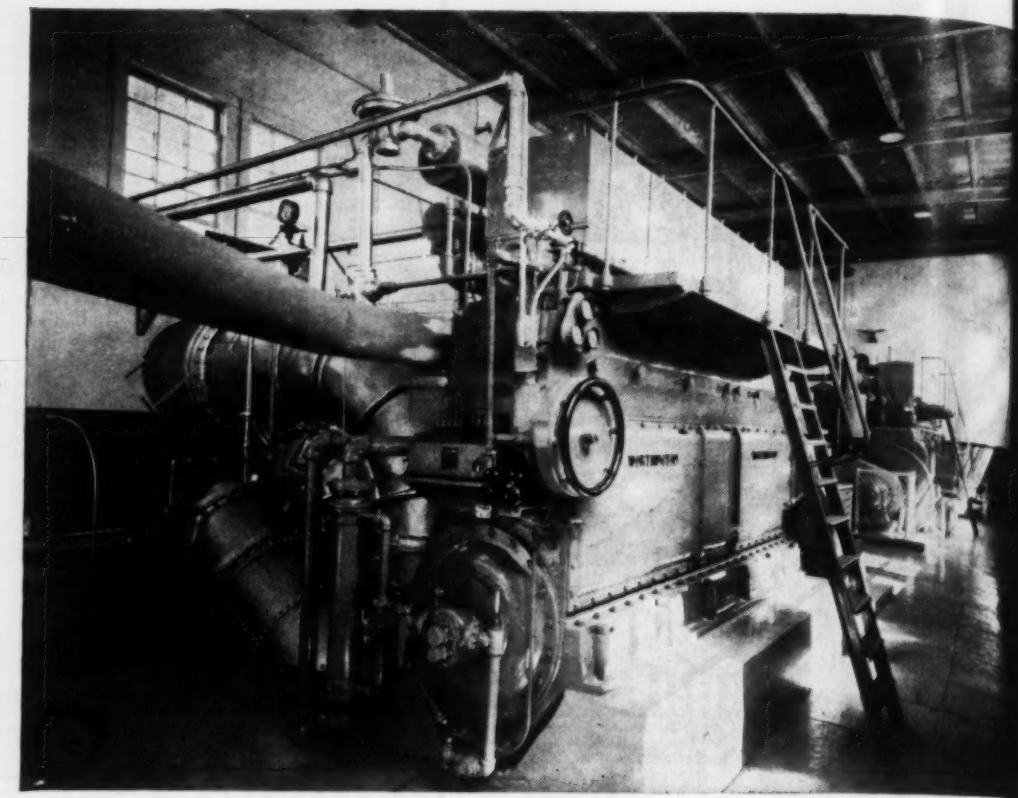
Recently, the bureau reinstated its program with an order to Worthington for the following units to be installed in the Queen Lane Raw Water Pumping Station:

Four	40 mgd, 260 ft TDH
Two	20 mgd, 260 ft TDH

The 40 mgd units are to be driven by 2250 hp unity power factor synchronous motors, the 20 mgd units by 1250 hp motors.

1

NEWS from the public works front



Two Worthington 500 hp gas engines at second relift station of irrigation system located at Weslaco, Tex

Steam to Electricity to Gas— and the Same Worthington Pumps

Worthington pumps installed in 1915 and 1918 in Hidalgo and Cameron Counties' Water Control and Improvement District No. 9 relift plant north of Weslaco, Texas, have survived several transitions at the prime mover end and today are still operating, now with power supplied by Worthington gas engines.

Originally the pumps were powered by a tandem compound steam engine directly connected to the pump shaft. After several years' operation on steam, the pumps were converted to electric drive by installation of synchronous motors on the old engine shaft at the point where the flywheel had been located.

After operating for several years on electric drive, the discovery of oil and gas in the Rio Grande Valley made gas a much cheaper power source, and so gas engines and chain drives were installed, with the sprockets of the drive installed on the old engine shaft where the rotors of the electric motors had been located.

The gas engines are Worthington 500 hp vertical enclosed engines operating at 360 rpm through a silent chain drive to Worthington 45 in. horizontal double suction volute centrifugal pumps delivering 70,000 gpm against 18.5 ft TDH at 120 rpm.

The engines are equipped with air filte exhaust silencers and a closed jacket wa system. The jacket coolers consist of bare t heat exchangers installed in the discha canal in front of the pump outlet, and a sm water softener treats the jacket makeup.

The drive is lubricated from the oiling sy tem of the main pump bearings. This syst consists of a small belted rotary oil pump d livering to an overhead oil filter and storag tank from which the oil flows by gravity to t main pump bearings and chain, and drains the base of the oil tight chain case, whence is picked up by the rotary pump.

A novel feature of the engine installation a friction brake to prevent the unit from r ning backwards in the event the main pu discharge flap or check valve failed to fu tion. This is a hand-operated brake appl to the flywheel rim, and on one occasion s the plant was built an accident occurred to discharge flap gate which would have pr ably caused serious damage to the engine this brake not been installed.

These Worthington units have been in s vice for six years and are giving excellent sults.

Public Works

NEWS

Veterans Hospital Contractor Using Blue Brutes 100%

thington "Blue Brutes" are doing their in breaking ground for the new Franklin Roosevelt Veterans Hospital in Crugers , near Peekskill, N. Y. Contracts totalling 400,000 have been awarded for this hos- for neuropsychiatric veterans, which will he largest Veterans Hospital in the United es.

he first contractor to start field work on 00 day job of transforming the 383 acre into a medical center was the Mt. Vernon tracting Corporation of Mt. Vernon, New , which has a $3,000,000 sub-contract xcavating, grading and other remodeling e topography. The Mount Vernon Con- ing Corporation is sub-contractor for itt, Chapman & Scott of New York City, Fred J. Brotherton, Inc., of Hackensack, , who have been awarded contracts for major portion of the project.

he Mount Vernon Contracting Corpora- is using 100% Worthington "Blue Brute" pment on its rock excavation job. At the ent time, there are nine 500-ft Diesel rtable Compressors, two 315-ft Diesel rtable Compressors, fourteen Wagon Drills, d eighteen Hand Held Rock Drills in eration.

Views of Worthington "Blue Brute" Compressors and Drills at site of Franklin D. Roosevelt Veterans Hospital

7-15

Worthington Pump and Machinery Corporation

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Harrison, N. J.

APPLICATIONS FOR ADMISSION OR TRANSFER

November 1, 1947 — Number 11

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know applicant personally as well as upon the nature and extent of his fessional experience. Any facts derogatory to the personal characte professional reputation of an applicant should be promptly comm cated to the Board. Communications relating to applicants are sidered strictly confiden

The Board of Direct will not consider the ap cations herein contained f residents of North Ame until the expiration of days, and from non-resid of North America until expiration of 90 days f the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	—
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

ALDERMAN, FRANK EDWARD (Assoc. M.) (Age 38) Chf. San. Engr., Holmes & Narver, Engrs., Los Angeles, Calif.

ARGRAVES, NEWMAN EDWARD (Assoc. M.) (Age 42) Partner, Argraves & Mort, Engrs., New Haven, Conn.

BENESCH, ALFRED (Age 50) Private practice as Alfred Benesch & Associates, Chicago, Ill.

BLAKESLEE, HAROLD LAW (Assoc. M.) (Age 60) Treas., Engr. and Supt., C. W. Blakeslee & Sons, Inc., New Haven, Conn.

BORISS, MARION ELMO (Assoc. M.) (Age 42) City Engr., Chattanooga, Tenn.

BRODIE, ROY NORMAN VARLEY (Age 50) Asst Structural Engr., Boston & Maine R.R., Boston, Mass.

CLARKE, CHARLES PHILLIP (Age 63) City Engr. (also in private practice), Greenville, Pa.

CLINE, LAWRENCE ALBERT (Age 55) Vice-Pres., United Concrete Pipe Corp., Los Angeles, Calif.

CONRAD, SAMUEL HENRY (Assoc. M.) (Age 47) Senior Engr. and Asst. Chf., Eastern Sec., Hospital Branch, War Dept., Alexandria, Va.

CORPITZEN, WILLIAM EDWARD (Assoc. M.) (Age 39) Engr., and Special Representative of Commr., U.S. Bureau of Reclamation, Washington, D.C.

COTTINGHAM, RALPH OLIVER (Age 61) Engr. and Supt., New Cache la Pondre Irrigation Co. and Cache la Pondre Reservoir Co., Greeley, Colo.

COWAN, ROBERT MERTON (Jun.) (Age 35) Engr., Corps of Engrs., St. Paul Dist., St. Paul, Minn.

GOMEZ-PEREZ, FRANCISCO (Assoc. M.) (Age 43) Asst. Mgr., Lezama y Cortiana, S.R.L.C.V., Mexico, D.F., Mexico.

HALL, WILLIAM NORMAN (Assoc. M.) (Age 69) Surveyor and Civ. Engr. (private practice), Arlington, Va.

HARNESS, ALBERT PRESTON, JR. (Age 52) Pres., The Jennings-Lawrence Co., Columbus, Ohio.

HARRISON, EDGAR SCRUGGS (Assoc. M.) (Age 42) Hydr. Engr., Georgia Power Co., Atlanta, Ga.

HUBER, WILLIAM GAY (Age 51), Mgr., International Eng. Co., Denver Branch Office, Denver, Colo.

KALTENBACH, CLIFTON JOSEPH (Age 49) Senior Design Engr., Dravo Constr. Co., Pittsburgh, Pa.

KENNEDY, WILLIAM VINCENT (Age 37) Topographic Engr., Sub-Area Chief, U.S. Geological Survey, Rolla, Mo.

MARSHALL, JAMES CREEL (Age 50), Pres., The Engr. Board, U.S. Army, Ft. Belvoir, Va.; address, Riverside, Conn.

MEBUS, GEORGE BRINKER (Assoc. M.) (Age 44) Cons. Engr., Glenside, Pa.

PACK, JOHN GEORGE, JR. (Assoc. M.) (Age 37) Prin. Engr., Chf. Military Constr. Branch, Office of Div. Engr., North Atlantic Div., Army Corps of Engrs., New York, N.Y.

PAYNE, ALBERT EDWARD (Age 38) Res. Engr. of Constr., United Engrs. & Constrs., Philadelphia, Pa.

PHIPPS, FRANCIS HARLOE (Assoc. M.) (Age 54) Civ. Engr., Dept. of Public Works, Bureau of Constr., New York City.

REED, CHARLES BERNARD (Age 49) Chf. Civ. Engr., and Traffic Mgr., South Porto Rico Sugar Co., Ensenada, Puerto Rico.

RUDDELL, RONALD HOLMES (Assoc. M.) (Age 58) Constr. Supt., United States Gypsum Co., Plaster City, Calif.

SHELLABY, JACK FRANCIS (Age 43) Area Project Engr., FPHA, Phoenix, Ariz.

SMITH, SAMPSON CARGILE (Assoc. M.) (Age 49) Dist. Engr., Dept. of Public Works, Baton Rouge, La.

STEFFES, ARNOLD MICHAEL (Assoc. M.) (Age 47) Chf. Design Engr., Utilities, Toltz, King & Day, Inc., St. Paul, Minn.

TARLTON, ELLIS ALVORD (Jun.) (Age 35) San. Engr., Danbury Water Dept., Danbury, Conn.

TYLER, JACK HENNIGAN (Jun.) (Age 35) Executive Officer, Civil Works, Office of Chief of Engrs., Arlington, Va.

APPLYING FOR ASSOCIATE MEMBER

BHATE, KRISHNAJI GOVIND (Age 41) Executive Engr. in charge Designs Div., Public Works Dept., Bombay, India.

COLLINS, HOWARD WILLIAM (Jun.) (Age 32) Estimating Engr., The Texas Co., Port Arthur, Tex.

COOK, MILTON FORD (Jun.) (Age 34) Associate Engr., U.S. Geological Survey, Chattanooga, Tenn.

CULP, DENNIS KING (Jun.) (Age 34) Lt. Comdr., Bureau of Yards and Docks, Arlington, Va.

DEVORE, RODNEY WALTER (Jun.) (Age 34) Engr. and Bldr. (private practice), Conneaut Lake, Pa.

DOE, FREDERICK HENRY, JR. (Age 34) Highway Design Engr., Arlington County Highway Div., Arlington, Va.

DUPES, KARL ADAM (Age 55) Engr., Waterways Experiment Station, Clinton, Miss.

ENKEBOLL, WILLIAM (Jun.) (Age 34) Engr., Dames & Moore, Foundation Engrs., Los Angeles, Calif.

FATIN, SALAH ELDIN (Age 37) Engr., Reservoirs Dept., Egyptian Govt., Cairo, Egypt; at present studying at Bureau of Reclamation, Denver, Colo.

FIELD, CLARENCE EDWARD (Age 41) Engr., Montague Pipe & Steel Co., San Francisco, Calif.

FLETCHER, JOSEPH FRANCIS (Jun.) (Age 32) Senior Engr. Designer, Air-conditioning & Ventilation Equipment, Frigidaire Div., GMC, Moraine City, Ohio.

FORBES, ROBERT (Jun.) (Age 35) Hydr. Engr., New England Div., Corps of Engrs., Arlington, Va.

FORREST, TOM HAMILTON (Age 35) Cons. San. Engr. (private practice), Chicago, Ill.

FUGE, KARL WILLIAM (Age 34) Structural Engr., James Mfg. Co., Fort Atkinson, Wis.

GAITHER, CORNELIUS GORDON (Jun.) (Age Cons. Engr., Howard K. Bell, Cons. Eng Lexington, Ky.

HEISEL, FREDERICK FRANK (Jun.) (Age 34) D Engr., Minnesota Dept. of Health, Manka Minn.

HOARE, BERTRAM WRIGHT (Age 36) Engr., Chief of Route Studies Sec., The Panama Ca Balboa Heights, C.Z.

HOLLYFIELD, PAUL DYER (Age 34) Senior En Lago Oil & Transport Co., Ltd., Aruba, N.W

HUGHEY, ALBERT STINSON (Age 56) Structu Eng. Associate, Dept. of Water & Power, Angeles, Calif.

KAAR, PAUL HARRY (Jun.) (Age 31) Engr. of Te Fritz Eng. Laboratory, Lehigh Univ., Bethleh Pa.

LEHMAN, FREDERICK GOODWIN (Jun.) (Age Structures Engr., Curtiss-Wright Corp., Cald N.J.

LOBENSTEIN, WALTER HENRY, JR. (Jun.) (Age Structural Designer-Detailer, Kirk Bradizban Structural Engr., Los Angeles, Calif.

MCILHENNY, THOMAS HENRY FRANKLIN (Ju (Age 35) Associate Engr., Terrell Bartlett Engr San Antonio, Tex.

MAJUMDAR, MANOJKUMAR (Age 30) Proprie Messrs. Shilpa Bitan, Dibrugarh, Assam, India

MAXWELL, GEORGE HENRY (Jun.) (Age 35) Eng North American Rayon Corp. and American Be berg Corp., Elizabethton, Tenn.

MAY, ARNOLD NICHOLAS (Jun.) (Age 30) Chf. Co servancy Engr., UNRRA, Shanghai, Chin Spring Grove, Ill.

MORALES, FRANCISCO JAVIER, JR. (Age 32) Ch Engr., Framorco, Inc., Panama City, Panama.

MORRIS, BROOKS THERON (Jun.) (Age 34) Grou Engr., Aircraft Research & Development Div Power Plant Research, Willys-Overland Moto Inc., Maywood, Calif.

PARKER, BURNS V., Compton, Calif.

ROOT, DARRELL ASTOR (Age 34) Superv. Civ. Engr East Bay Municipal Utility Dist., Oakland, Calif

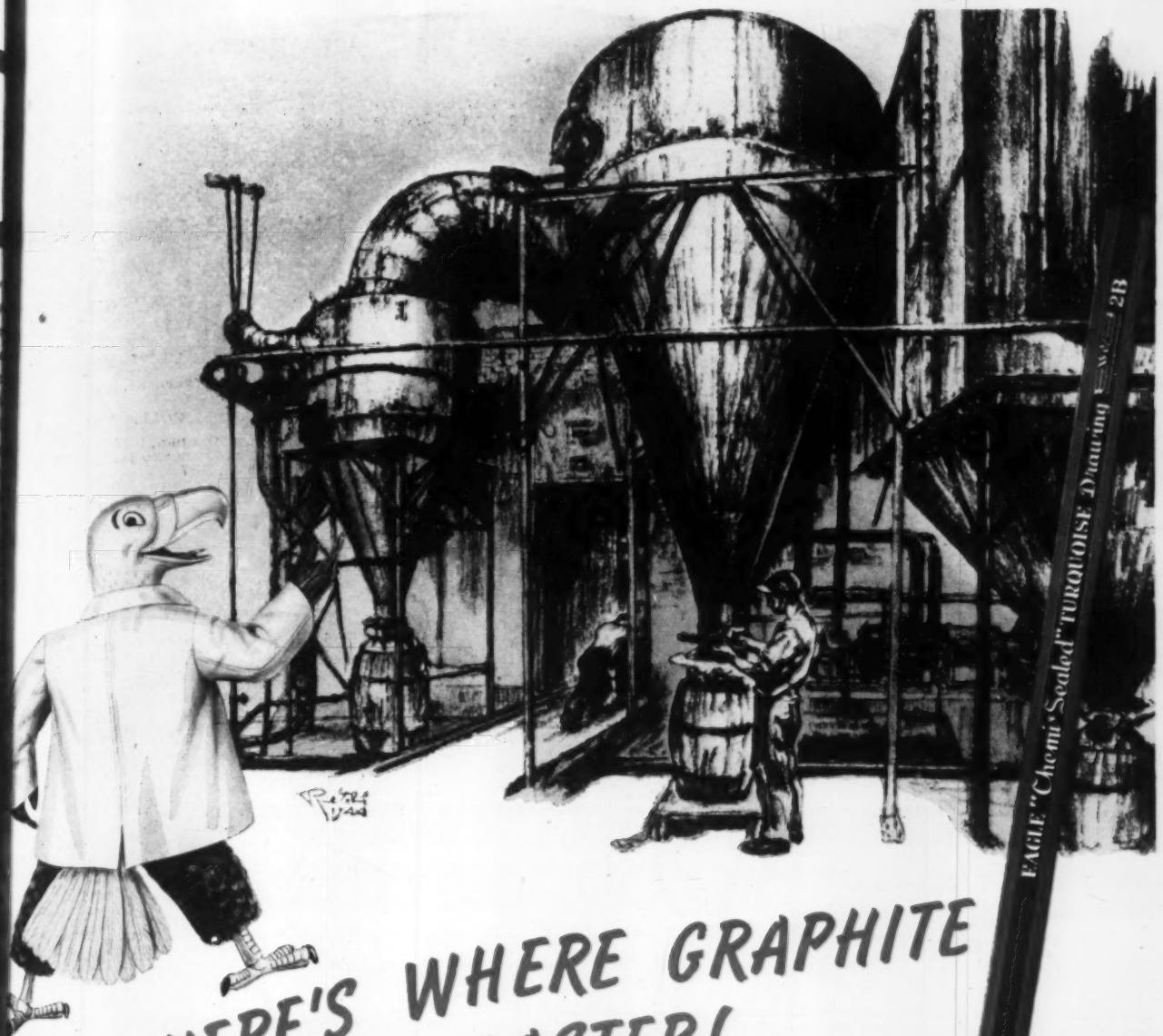
RUTTER, MARTIN LUTHER (Jun.) (Age 35) Comdr CEC, U.S. Navy, Naval Research Laboratory Washington, D.C.

SEEGER, WILLIAM ROBERT (Jun.) (Age 35) Asso ciate Engr., Eng. Office of Clyde C. Kennedy San Francisco, Calif.

SMITH, WALTER PRESTON (Jun.) (Age 34) Ass Highway Engr., California Dept. of Publi Works, Div. of Highways, San Francisco, Calif.

TATHAM, NORMAN JOHN (Jun.) (Age 34) Eng Designer A, Douglas Aircraft Co., Huntington Park, Calif.

TICE, RICHARD HOWELL (Jun.) (Age 34) Associat Hydr. Engr., U.S. Geological Survey, Charlottesville, Va.



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TONEY, MARTIN (Jun.) (Age 34) Designer, Bridge Div., Arizona Highway Dept., Phoenix, Ariz.

WEDDING, PRESLEY ALLEN (Jun.) (Age 35) Civ. Engr. with Bernard F. Locraft, Chevy Chase, Md.; also Instructor, Dept. of Architecture, Catholic Univ. of America, Washington, D.C.

WHITE, CHARLES BERNARD, JR. (Age 43) Chf., Valuation Div., Nevada Tax Comm., Carson City, Nev.

WILSON, MERLE EVERETT (Age 42) Engr. Aid V, County of Los Angeles, Dept. of Surveyor & Engr., Los Angeles, Calif.

APPLYING FOR JUNIOR

BERGERSON, WALLACE WILSON (Age 30) Asst. Engr., Pollution Control Comm., State of Washington, Olympia, Wash.

DAUGHERTY, GEORGE FERRELL (Age 27) Civ. Engr., Humble Oil & Refining Co., Midland, Tex.

HUFFMAN, WILLIAM BRYNER (Age 29) Civ. Engr., U.S. Bureau of Reclamation, Salt Lake City, Utah.

NARASIMHAIAH, DODDAHEJJAJI BYRALINGAIAH (Age 29) Graduate student, Illinois Inst. of Technology, Chicago, Ill.

OMARI, SHAKIB MUHAMMAD (Age 30) Civ. Eng., Ministry of Public Works & Communications, Southern Syria Dist., Damascus.

RICHARDSON, JACK QUINCY, JR. (Age 25) Draftsman, Structural Dept., Wilbur Watson Associates, Painesville, Ohio.

RYDER, ROBERT RALPH (Age 27) Civ. Engr., P-2, Tech. Sec., Veterans Administration, Ft. Snelling, St. Paul, Minn.

THOMPSON, MYRON OTIS (Age 28) Civ. Engr., Worden-Allen Co., Milwaukee, Wis.

TIMME, ALEXANDER (Age 28) Field Engr., United Engrs. & Constrs., Inc., Philadelphia, Pa.

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RHODES, EUGENE IRVING, 1946	(23)
CALIF. INST. TECH.	
RAMASWAMY, GURUVAYUR SUBRAMANYAM, 1947	(24)
RICHESON, WILL, JR., 1947	(23)
CLARKSON COLL. TECH.	
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GREEN, ROBERT WILLIAM, 1947	(22)
GA. SCHOOL TECH.	
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BLAZ, HERBERT EARL, 1947	(22)
CLAUSSEN, ROBERT WILLIAM, 1947	(22)
HARZA, RICHARD DAVIDSON, 1947	(24)
HOLAB, SIDNEY HIRSCH, 1947	(24)
MILLER, RAYMOND HERBERT, 1947	(24)
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The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

CHANGES IN MEMBERSHIP GRADES

ADDITIONS, TRANSFERS, REINSTATEMENTS, AND RESIGNATIONS

(From September 10 to October 9, 1947)

Additions to Membership

ADAMS, RICHARD STANFORD (Jun. '47) Asst. Engr., East Bay Municipal Utilities Dist., 22nd and Adeline (Res., 2702 High St.), Oakland, Calif.

ALLEN, ROBERT DAVID (Jun. '47) Junior Civ. Engr., Div. of Highways (Res., 1005 G St.), Marysville, Calif.

APPEL, DAVID WOODHULL (Jun. '47) Test Engr., General Elec. Co., River Works, Lynn (Res., 15 Riverside Court, East Saugus), Mass.

ARCHER, LAWRENCE JOSEPH (M. '47) With City Engr.'s Office (Res., 334 Garces Drive), San Francisco, Calif.

ARNTZEN, JOHN CHRISTIAN (M. '47) Chf. Engr., Mississippi Valley Structural Steel Co., 25th & Norwood, Melrose Park (Res., 295 Adelia St., Elmhurst), Ill.

AUFFANT, EUGENE JOSEPH (Jun. '47) Design Engr., Capitol Eng. Corp. (Res., Box 243), Dillsburg, Pa.

BETTS, CONKOY FRANCIS DARROW (Jun. '47) Asst. Engr., Crocker Estate Co., 660 Market St., San Francisco, Calif.

BIDWELL, WAYNE MCGRANAHAN (Assoc. M. '47) Hydr. Engr., U.S. Section International Boundary and Water Comm., 627 First National Bank Bldg. (Res., 1414 North Piedras, Apt. 31), El Paso, Tex.

BLACK, CHARLES THOMAS (Jun. '47) Junior Engr., Shell Oil Co., Box 262, Wood River (Res., Box 132, Roxanna), Ill.

BLACK, JAMES EVAN, JR. (Assoc. M. '47) Senior Design Engr., State Dept. of Highways, Bridge Office, Frankfort (Res., 203 North Broadway, Lexington), Ky.

BLACK, WILBUR CHARLES (Assoc. M. '47) Designer, Howard, Needles, Tammen & Bergendoff, Cons. Engrs., 921 Walnut St. (Res., 3505 East 69th St.), Kansas City 5, Mo.

BOLLING, ALBERT STUART, JR. (Jun. '47) Engr., Lock Joint Pipe Co., Ampere, N.J.

BOWEN, WILLIAM CASON (Assoc. M. '47) Engr., Public Works Comm., City of Spartanburg, R.F.D. 2, Chesnee, S.C.

BOWMAN, EUGENE CRONAN (Assoc. M. '47) Civ. Engr., Corps of Engrs., War Dept., Memphis Dist., Memphis, Tenn.

BRAKEBILL, CECIL AMOS (Jun. '47) Draftsman, Stanolind Oil & Gas Co. (Res., P.O. 1410), Fort Worth, Tex.

BRITTAIN, WILLIAM KENNETH (Assoc. M. '47) Res. Engr., State Highway Dept., Glendive, Mont.

BUDAY, JOHN FRANCIS (Jun. '47) Senior Draftsman, Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh (Res., 521 Park Ave., Clairton), Pa.

BURKS, SAMUEL DAVID (Assoc. M. '47) Dist. Concrete Technician, Corps of Engrs., Sacramento Dist., 1209 Eighth St., Sacramento, Calif.

BURTON, LEROY HAROLD (Jun. '47) Engr., Civ. Bureau of Reclamation, Denver Federal Center Bldg. (Res., 2545 South Vine), Denver, Colo.

CALLAHAN, DANIEL EDWARD (M. '47) Engr. Rapid Transit Lines, Boston Elevated Ry. Boston (Res., 28 Waite St., Malden), Mass.

CAMPBELL, DAVID ROBERT (Jun. '47) Structural Draftsman, New England Power Service Co. 441 Stuart St. (Res., 78 Peterboro St.), Boston Mass.

CHENG, DAVID HONG (Jun. '47) Graduate Student Columbia Univ., Care, Civ. Eng. Dept., Columbia Univ., New York, N.Y.

CLARE, HERBERT CECIL (M. '47) Director of Div. of Public Health Eng., Dept. of Public Health 422 State House, Boise, Idaho.

CLARKE, HERBERT RENTOUL (M. '47) Chf. Engr. Chicago, Burlington & Quincy R.R. Co., 547 West Jackson Blvd., Chicago (Res., 110 South Kensington Ave., La Grange), Ill.

CLEAVELAND, ALTON BRUCE, JR. (Jun. '47) Rodman, Chicago & North Western Ry., Office Div. Engr., C. & N.W. Ry., Boone, Iowa.

COETSEE, ANDREAS (Jun. '47) Junior Asst. Engr. Municipality Bloemfontein, Care, City Engr. Dept., Bloemfontein, South Africa.

(Continued on page 94)

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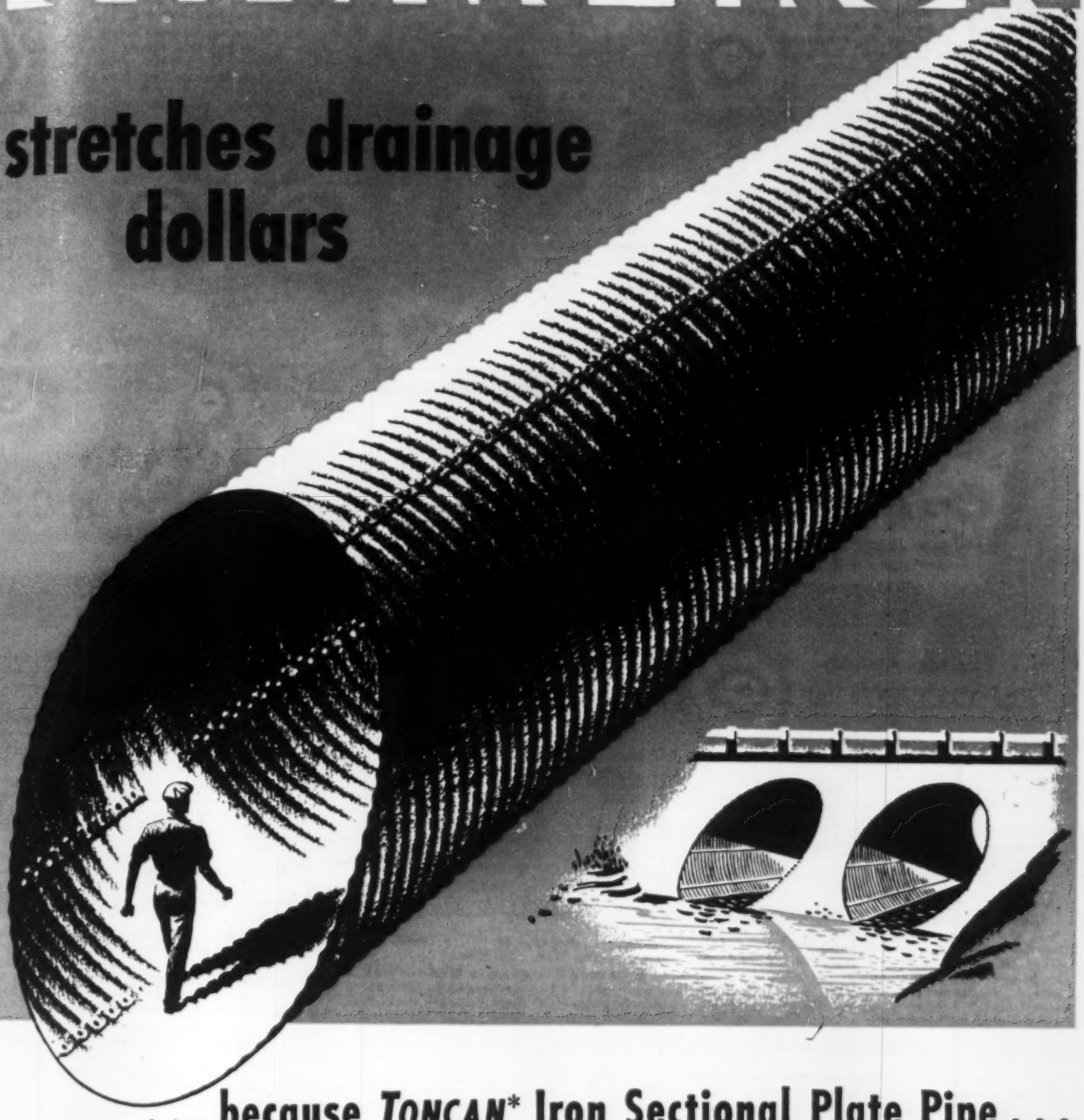

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COOK, RONALD ROY (Jun. '47) Draftsman and Junior Engr., G. O. Hall & Associates, Cons. Engrs., Larson Bldg. (Res., 907 North 9th Ave.), Yakima, Wash.

DAS, PRAMATHA LAL (Assoc. M. '47) Asst. Inspecting Officer, Dept. of Industries and Supplies, Inspection Branch, P-18 Mission Row Extension, Calcutta (Res., P.O. Jadavpur College, 24 Parganas, West Bengal), India.

DAVIS, ELLSWORTH INGALLS (Assoc. M. '47) Lt. Col., Asst. Supervising Engr., The Panama Canal, Box 1005, Diablo Heights, Canal Zone.

DIRIKER, EKMEL NECIP (Jun. '47) Asst. to Chf. Engr., M. W. Kellogg Co., P.O. Box 591, Whiting, Ind. (Res., Adakale 70 Yenisehir, Ankara, Turkey.)

DODSON, ROY EUGENE, JR. (Assoc. M. '47) San. Engr., San Diego Water Dept., 602 Civic Center, San Diego 1, Calif.

DREYER, JOHN VICTOR HERBERT (Jun. '47) Junior Civ. Engr., Board of Transportation, 566 West 181 St., New York (Res., 42-22 One hundred sixty-first St., Flushing), N.Y.

ELDRED, GEORGE E. (M. '47) Dist. Engr., Public Roads Administration, 105 Monona Ave. (Res., 311 North Murray St.), Madison 5, Wis.

ENGLUND, ROBERT WOODROW (Jun. '47) Civ. Engr., Paper, Calmenson Co., Walnut St. and County Road B, St. Paul (Res., 3517 Park Ave., Minneapolis 7), Minn.

FLOOD, JOHN HEBARD, JR. (Jun. '47) Eng. Draftsman, Reynolds, Smith & Hills, Archts. and Engrs., 10 South Laura St. (Res., 2116 Dellwood Ave.), Jacksonville 4, Fla.

FORD, JOHN MARTIN, JR. (Jun. '47) Instr., Clemson Agricultural College, Eng. Dept. (Res., Box 1177), Clemson, S.C.

FOX, EDWARD ALEXANDER (Jun. '47) Asst. Engr., Stock Construction Co., Grand Central Terminal Bldg. (Res., 147 West 86th St.), New York, N.Y.

FRANKFURT, DANIEL (Jun. '47) Designer, American Cyanamide Co., 1240 Sixth Ave. (Res., 3470 Cannon Pl.), New York 63, N.Y.

FRUCHTBAUM, JACOB (M. '47) Cons. Engr., 615 Jackson Bldg., Buffalo 2, N.Y.

FUGERE, DONALD EDWARD (Jun. '47) Junior Engr., Ford Motor Co. (Res., 700 Delaware), Detroit, Mich.

FULLER, RAYMOND HAROLD (M. '47) P... Burgess & Niple, 568 East Broad St. (Res... Blenheim Rd.), Columbus, Ohio.

GALLINGER, RALPH HENRY (M. '47) Engr., C... Engrs., War Dept., 930 Ellicott Square, B... (Res., 8805 Pershing Ave., Niagara Falls)...

GOETZMAN, ROBERT RENN (Jun. '47) Engr., L... ville Builders Supply Co., 1032 South Eigh... (Res., 149 Vernon Ave.), Louisville, Ky.

GRAFF, WILBUR LEE (Jun. '47) Assn. Planning E... Louisville Area Development Assn., 301 ... 5th St., Louisville (Res., Route 2, Jefferson... Ky.

GRAYSON, LAUREN WILLIAM (M. '47) Supt., ... tric Light and Water Depts., Dept. of P... Utilities, P.O. Box 826, Riverside, Calif.

GUSTAFSON, JOHN HILMER (M. '47) Dist. M... Ceco Steel Products Corp., 1926 South ... Ave., Cicero (Res., 5333 North Sawyer ... Chicago 25), Ill.

HAMLYN, EDWIN ELIAS (Assoc. M. '47) Asst. ... Civ. Eng., Special Eng. Div., The Panama C...

(*Continued on page 96*)

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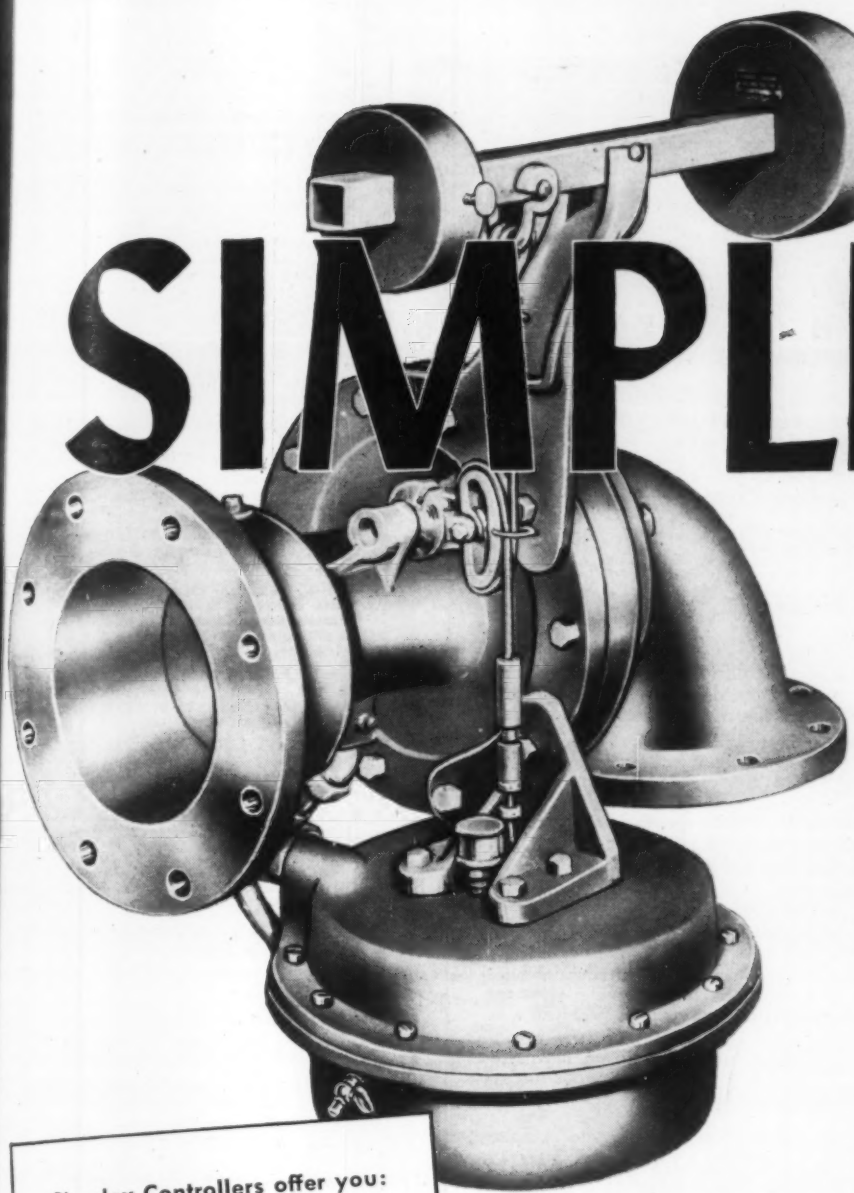

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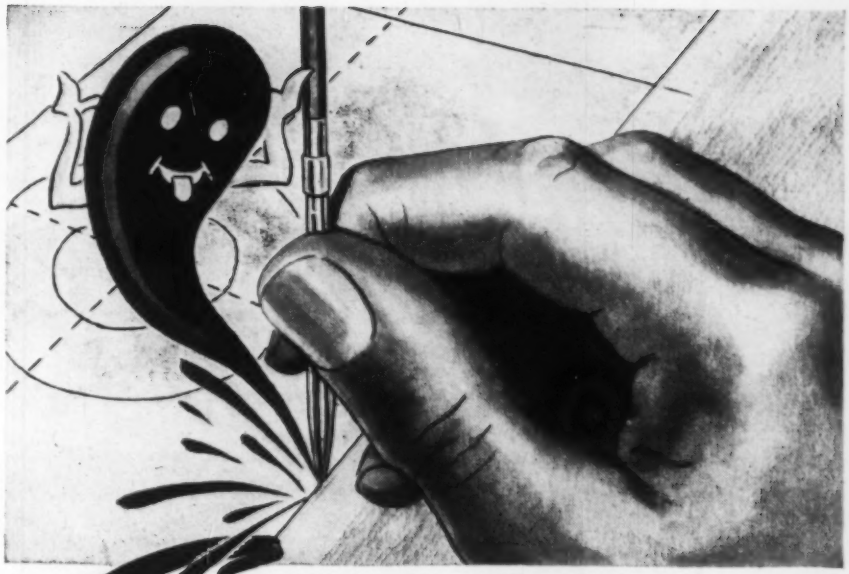

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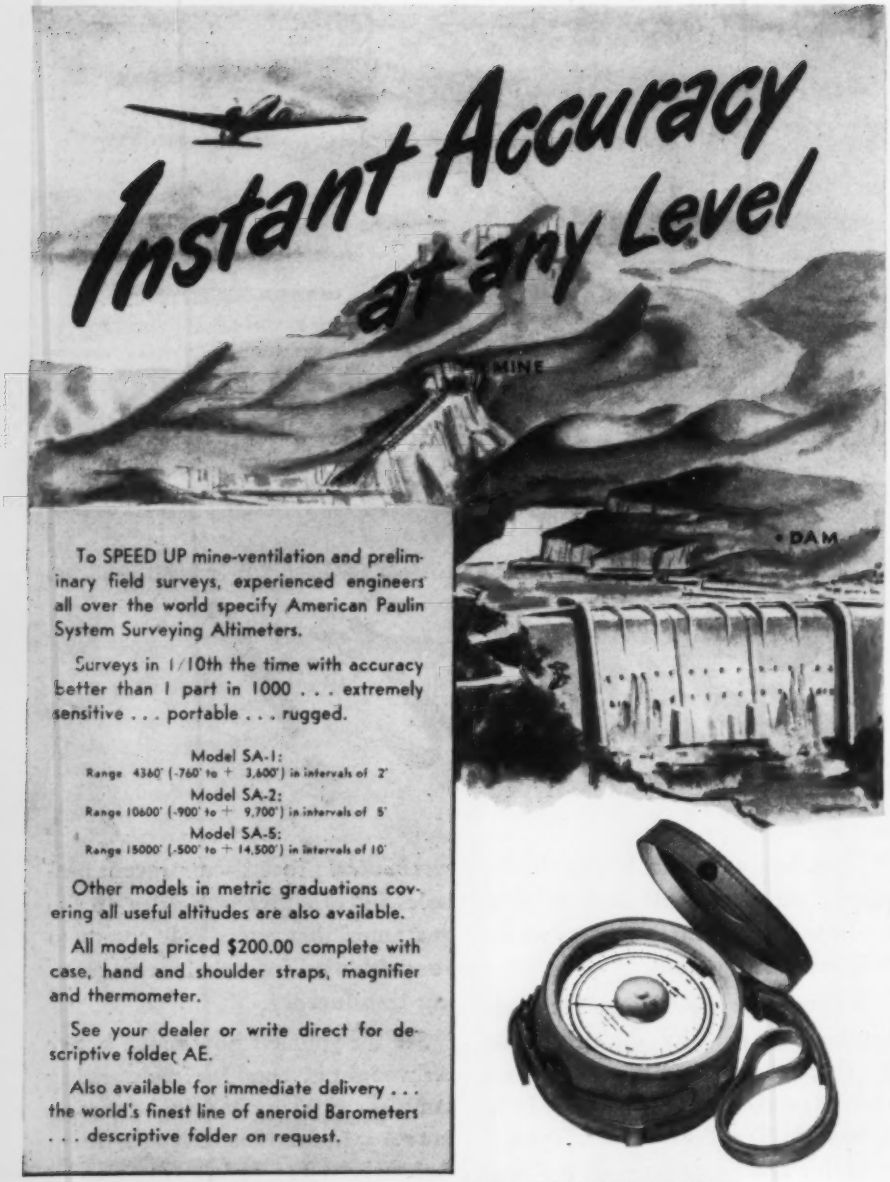

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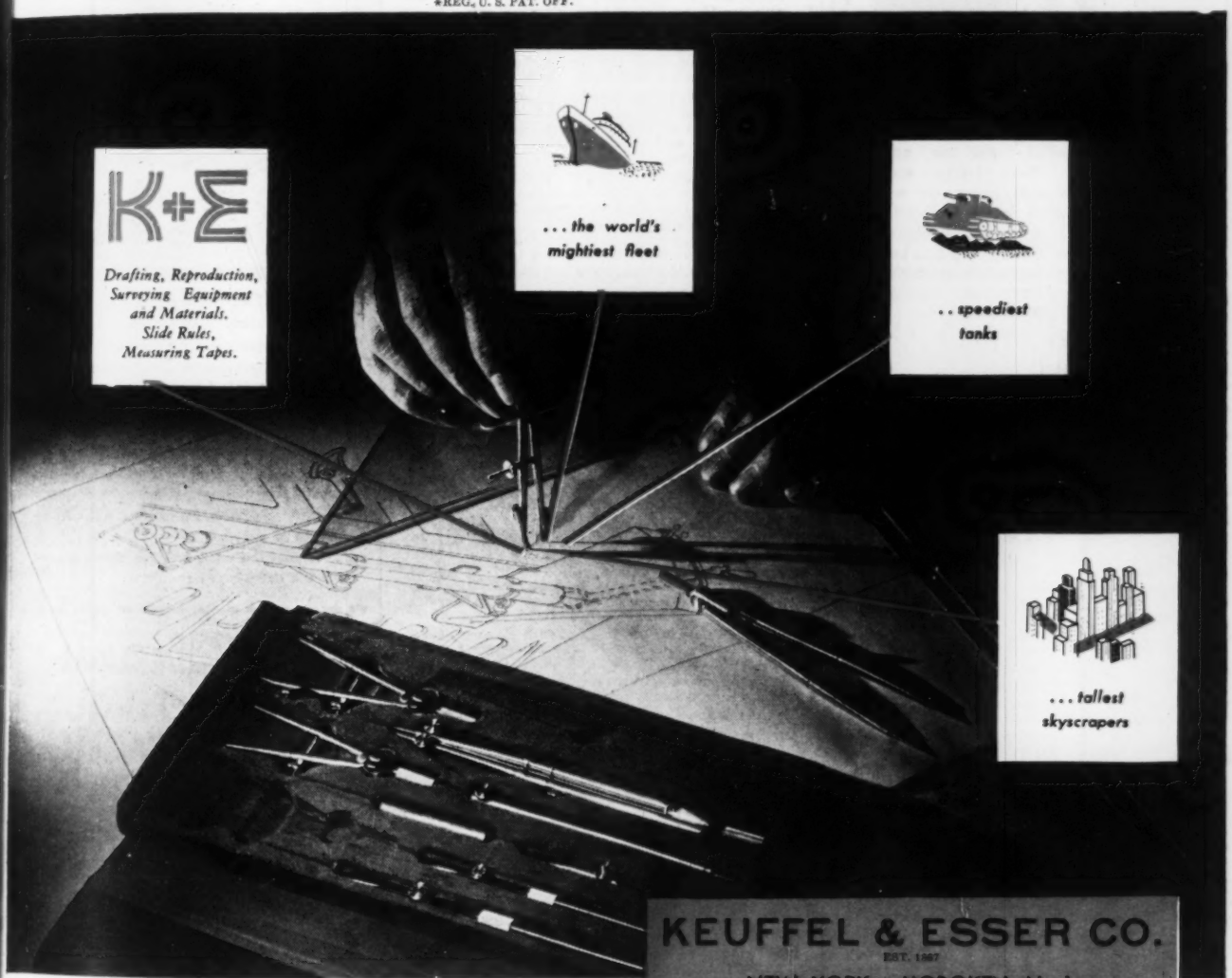
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COPELAND, RONALD EVERETT (Assoc. M. '30; M. '47) Director of Eng., National Concrete Masonry Assn., 38 South Dearborn St., Chicago 3, Ill.

DUCLOS, FRANCIS GEORGE (Jun. '42; Assoc. M. '47) Asst. Engr., Metcalf & Eddy Engrs., 1300 Statler Bldg., Boston (Res., 3 Trull St., Dorchester), Mass.

ELDER, REX ALFRED (Jun. '40; Assoc. M. '47) Associate Hydr. Engr., Tennessee Valley Authority, Hydr. Laboratory, Norris, Tenn.

FERRIS, CHARLES BIRDSALL (Jun. '28; Assoc. M. '31; M. '47) Vice-Pres., Gramatan National Bank & Gramatan Co., 116 Kraft Ave., Bronxville (Res., 30 Locust Hill Ave., Yonkers), N.Y.

GAIN, EDWARD JACOB ARTHUR (Assoc. M. '37; M. '47) Engr. in Chg. of Sewer Design, City of St. Louis Board of Public Service, Room 300, City Hall, 12th and Market (Res., 6023 Enright Ave.), St. Louis 12, Mo.

GATEWOOD, JOSEPH STRONG (Assoc. M. '30; M. '47) Hydr. Engr., U.S. Geological Survey, Box 1311 (Res., 1001 East Edison St.), Tucson, Ariz.

GOLZE, ALFRED RUDOLF (Jun. '32; Assoc. M. '38; M. '47) Director, Office of Programs and Finance, Bureau of Reclamation, Dept. of Interior, Washington 25, D.C. (Res., 5506 Brite Drive, Bethesda 14, Md.)

HALES, ALBERT JOSEPH (Jun. '41; Assoc. M. '47) Pres., A. J. Hales & Co., Inc., 959 Thirty-second St., Oakland 8, Calif.

HAZEN, RICHARD (Jun. '34; Assoc. M. '39; M. '47) Partner, Malcolm Pirnie Engrs., 25 West 43rd St., New York 18, N.Y.

HOFFMAN, ARTHUR AARON (Jun. '39; Assoc. M. '47) Secy.-Treas. and Chf. Engr., Golden Gate Iron Works Inc., 1541 Howard St. (Res., 5426 Fulton St.), San Francisco, Calif.

HOKE, JOHN BOYD (Assoc. M. '27; M. '47) (Skelly & Hoke, Engrs. and Constrs.); Mgr. and Partner, Asphalt Products Co.; Secy. and Treas., Potomac Constr. Co., 650 West Race St., Martinsburg, W.Va.

JENKS, DOWNING BLAND (Jun. '37; Assoc. M. '47) Div. Supt., Great Northern Ry. Co., Great Northern Passenger Station, Spokane, Wash.

KENNEDY, DANIEL (Assoc. M. '36; M. '47) Chf., Operations and Planning, Army Map Service, 6500 Brooks Lane, Washington 16, D.C.

KULHAN, EDWARD FRANK (Jun. '40; Assoc. M. '47) Geodetic Engr., Inter-American Geodetic Survey, Box 2031 (Res., Box 203), Balboa, C.Z.

KULLAS, ALBERT JOHN, JR. (Jun. '38; Assoc. M. '47) Project Stress Engr., The Glenn L. Martin Co. (Res., 3604 White Ave.), Baltimore 6, Md.

LAMOREAUX, RAYMOND (Jun. '32; Assoc. M. '47) Comdr., C.E.C., U.S.N., Bureau of Yards and Docks, Washington, D.C. (Res., 4851-B South 28th St., Arlington, Va.

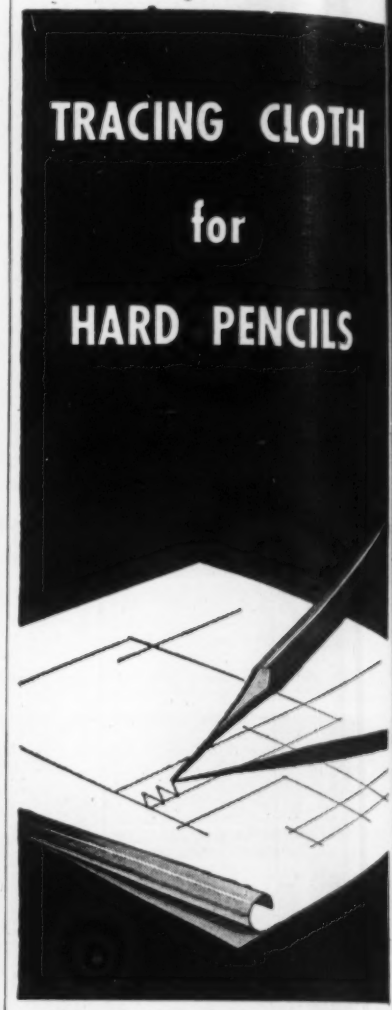
LARSON, HOWARD DREW (Jun. '37; Assoc. M. '47) Design Mgr., Public Works Dept., U.S. Navy, Treasure Island (Res., 523 Font Blvd.), San Francisco 12, Calif.

LEWIS, ROBERT LOYD (Jun. '40; Assoc. M. '47) Prof. and Head, Civ. Eng. Dept., Colorado Agri. and Mech. College, Fort Collins, Colo.

LUECKER, ARTHUR ROWE (Jun. '39; Assoc. M. '47) Civ. Engr., Knappen Eng. Co., 280 Madison Ave., New York, N.Y.

MATTHIAS, FRANKLIN THOMPSON (Assoc. M. '37; M. '47) Project Mgr., Sao Paulo Tramway, Light & Power Co., Ltd., Caixa Postal 571, Rio de Janeiro, Brazil.

MAUTZ, FERDINAND FRANCIS (Jun. '36; Assoc. M. '47) Asst. Engr., Pacific Gas & Elec. Co., 245 Market St., San Francisco, Calif.



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ORHON, EKREM (Jun. '36; Assoc. M. '47) Contr.-Chf. Engr., Yuksek Muhendis, Rize, Turkey.

PELLER, PHILLIP ALLEN (Jun. '36; Assoc. M. '47) Chf. Tech. Adviser, Tangku New Harbor Constr. Bureau, Tientsin, China.

PRANGE, HERBERT LOUIS (Jun. '39; Assoc. M. '47) Supervisor, Alvin Wunderlich Lumber Co. (Res., P.O. Box 166), Caruthersville, Mo.

PUTMAN, CLARENCE (Jun. '38; Assoc. M. '47) Civ. Engr., Tennessee Valley Authority, Pound Bldg., Chattanooga, Tenn. (Res., 617 Commonwealth Ave., Bristol, Va.)

QUIMBY, PAUL JAY (Assoc. M. '35; M. '47) Senior Designer, Bethlehem Steel Co. (Res., 2002 Montgomery St.), Bethlehem, Pa.

REIDY, PETER JOSEPH (Assoc. M. '40; M. '47) Pres., Purdy & Henderson Associates Inc., 1 Madison Ave., New York 10, N.Y.

RIEDEL, CARL MARTIN (Assoc. M. '39; M. '47) Partner and Cons. Engr., Chemical Soil Solidification Co., 7658 South Laflin St. (Res., 8022 Paxton Ave.), Chicago 17, Ill.

SHEETS, FRANK THOMAS, JR. (Jun. '38; Assoc. M. '47) Plant Engr., Southwestern Portland Cement Co., Osborn, Ohio.

STERNBERG, LEO AARON (Jun. '44; Assoc. M. '47) Sanitarian, U.S. Public Health Service, 15 Pine St., New York (Res., 249 Troy Ave., Brooklyn 13), N.Y.

TUDOR, RALPH ARNOLD (Jun. '30; Assoc. M. '34; M. '47) Member of firm, Seage & Tudor, 932 Monadnock Bldg., San Francisco (Res., 534 Center Drive, Palo Alto), Calif.

WANNAMAKER, WILLIAM WHETSTONE, JR. (Jun. '22; Assoc. M. '30; M. '47) Care, Wannamaker & Wells Inc., Orangeburg, S.C.

WILLIAMS, LEONARD OLIVER, JR. (Assoc. M. '37; M. '47) Director, Div. of Public Health Eng., State Dept. of Public Health, State Capitol, Cheyenne, Wyo.

WOODWARD, HAROLD STONE (Jun. '23; Assoc. M. '31; M. '47) Associate Engr., Seelye, Stevenson & Value, 101 Park Ave. New York (Res., 138 Rockland Ave., Larchmont), N.Y.

ZELNICK, ERNEST WILLIAM (Jun. '37; Assoc. M. '47) Engr. The Panama Canal (Res., P.O. Box 474), Balboa Heights, C.Z.

Reinstatements

BHATT, UPENDRA JIVANRAM, M., Chf. State Engr., Public Works Dept., Bhavnagar State (Res., Hill Drive), Bhavnagar, India., readmitted Aug. 11, 1947.

BIRKE, HAKAN DANIEL, Assoc. M., Civ. Engr., Svenska Industribyggen AB, N. Stationsgatan 75-77, Stockholm, Sweden, reinstated Sept. 4, 1947.

BRIGANTI, THEODORE, JUN., Engr., Civ. and San., Creole Petroleum Corp., Apartado 889, Caracas, Venezuela, reinstated Sept. 20, 1947.

BURKETT, CARL COBB, Assoc. M., Asst. Highway Engr., State Highway Dept. (Res., 2401 State St.), Little Rock, Ark., reinstated Sept. 2, 1947.

CERVINO, WILLIAM NICHOLAS, Assoc.. M., 175 Sheridan Ave., Paterson, N.J., reinstated Sept. 19, 1947.

DOUGLASS, GLENN DRURY, Assoc. M., Chf., Rehabilitation Branch, War Assets Administration, Porbeck Bldg., Little Rock (Res., 317 Olive St., Parkhill, North Little Rock), Ark., reinstated Sept. 11, 1947.

GRISWOLD, HECTOR CLINTON, M., Burns & Roe, 233 Broadway, New York, N.Y. (Res., 28 Hillcrest Ave., Summit, N.J.), readmitted Sept. 8, 1947.

MCNEAL, DONALD HAMLIN, M., Chateau Normandy, Apt. 1-G, Scarsdale, N.Y., reinstated Sept. 19, 1947.

NAGTEGAAL, GERRIT PAUL, Assoc. M., Bridge Designer, Atchison, Topeka & Santa Fe. R.R., 80 East Jackson Blvd., Chicago, Ill., readmitted Sept. 8, 1947.

PACE, CLYDE WILSON, JR., Jun., Airport Engr. Dept. of Business and Administration, Missouri Div. of Resources and Development, State Office, Bldg., Jefferson City, Mo., reinstated Sept. 9, 1947.

POPE, HERBERT BOWMAN, Assoc. M., Pres., H. B. Pope Co., Inc., 200 South Park Ave., Sanford, Fla., reinstated Sept. 11, 1947.

SCOFIELD, WALTER FLEMING, Assoc. M., Associate Prof. of Civ. Eng., Univ. of Alabama (Res., P.O. Box 356), University, Ala., reinstated Sept. 30, 1947.

SHIELS, THOMAS DAVID, Assoc. M., Field Engr., Portland Cement Assn., Tower Petroleum Bldg., Dallas (Res., 2301 Mistletoe Ave., Forth Worth), Tex., reinstated Sept. 4, 1947.

YOUNG, FRANCIS DEWEY, Assoc. M., 238 Waverly St., Berea, Ohio., reinstated Sept. 30, 1947.

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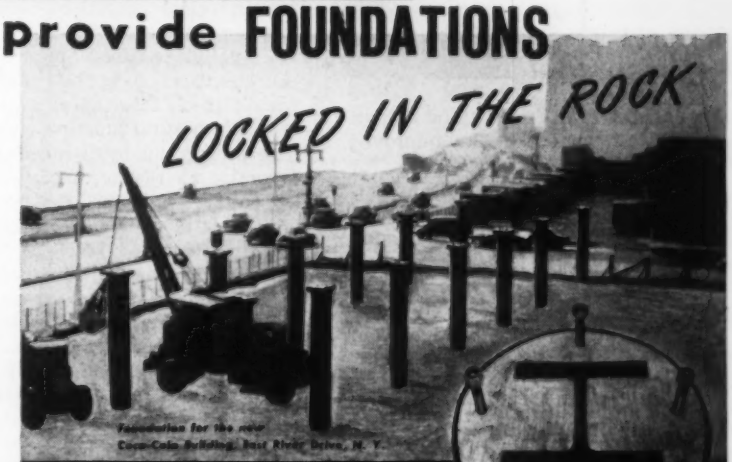

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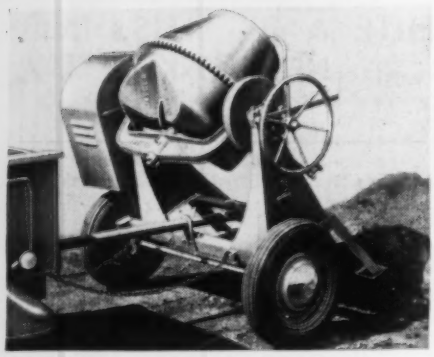
Redesign of Construction and Road-Building Equipment

BLAW-KNOX COMPANY announces that it has just completed a redesign of a major portion of its line of construction and road-building equipment. Highlighted in this development of new and improved items is a revolutionary type of road subgrader for paving construction that utilizes vibration to disintegrate and cut through the material to be excavated. Also included are a streamlined "Hi-Boy Trukmixer," an improved high-speed vibratory paving spreader, a newly developed widening finisher, twin weighing batchers and a new portable bulk cement plant.

Improved Mixer



JAEGER MACHINE COMPANY of Columbus, Ohio, has announced an improved 3½-S end-discharge, tilting mixer for mixing concrete, plaster, and bituminous materials. The design differs from other machines in that it is towed in mixing position with support legs at the rear. Thus, the unit may be backed directly up to material piles and is immediately ready to work. Wheelers can approach from either side and leave without reversing direction. Another exclusive feature is the V-bottom drum design which combines with two double mixing blades to produce fast, criss-cross movement of the material.

Scoop-Dump Electric Truck

THE SLOW laborious, and limited wheelbarrow has been economically superseded by a scoop-dump electric truck. It can be used to carry materials from dumps to work areas or processing stations or to warehouses. The principal advantages of the truck are: it saves labor, speeds up work, is versatile, and mechanically picks up and dumps from various levels. The truck is made by The Yale & Town Manufacturing Company Phila., Pa.

New Heiliner

THE new Heiliner, the two-wheel, full-traction, power unit recently announced by The Heil Co., Milwaukee, is a new unit which has been developed over a period of five years. Offering many desirable features never before available in the construction field, the Heiliner is interchangeable with Heil 16-yd scrapers and 18-yd bottom dump wagons. Hydro-steer, first fully hydraulic, exclusive Heil steering mechanism provides finger-tip steering. Positive steering prevents possibility of "jack-knifing" and "hunting."

Earth Resistivity Apparatus

BY MEANS OF measurements made at the surface of the earth, the Gish-Rooney Earth Resistivity Apparatus, created by the Geophysical Instrument Company, Arlington, Va., gives information concerning geological conditions below the surface of the earth. Such information is usually obtained prior to drilling or excavating. As a result of its capabilities in this respect it serves the following important functions: aids in petroleum prospecting by discovering structures favorable to the accumulation of petroleum; faults, lenses, domes, anticlines, etc.; aids in mineral prospecting by discovering structures favorable to the accumulation of minerals; locates certain minerals directly by their electrical properties, outlines and estimates depth of mineral deposits; in ground water prospecting, it locates water-bearing formations and estimates their depths; and in Civil Engineering sub-surface investigations, it locates and measures depth to bedrock, locates faults and geological features, water-bearing layers and gravel deposits, and gives information concerning stratification of overburden.

Concrete Block Fork

THE SCHMIDGALL MFG. CO., Peoria, Ill. describes a lift truck fork which eliminates the need of pallets and which has proved to be a big time saver and a serviceable addition to the modern lift truck. It consists of a heavy-duty automatic mechanism of simple, rugged design. Model 33 will handle standard 4″, 6″, 8″ and 12″ blocks whether made of Waylite, Cinder, or Concrete Process. The capacity of the fork is limited only by the capacity of the lift truck on which it is used. It can be mounted or detached in two minutes or less, and the prongs are self-cleaning.

New Compressor

THE NEW "85" Airmaster Compressor is announced by Le Roi Company, Milwaukee, Wis. The compressor, built integrally into the engine block, is liquid cooled and also has pressure lubrication, replaceable cylinder sleeves, and precision bearings. Cylinder head and compressor valves are identical to those of their entire Airmaster series of portables.

Compressor is regulated by the Le Roi patented Econotrol controlling compressor operating automatically according to the demand for air. Electric starting and the exclusive Electric hourmeter are supplied as standard equipment.

Attachment for Track-Type Tractor

THE HYSTAWAY ATTACHMENT for the "Caterpillar" Track-Type Tractor is now available on a current delivery basis for the D8 Model. This versatile unit which combines a dragline, clamshell, and crane with the mobility of a track-type tractor, has been used on the D6 and D7 "Caterpillars" and has been released for the larger D8 Model after more than a year of testing. Specifications now call for a ½ cu yd bucket on the D7 and D8 with a ⅜ cu yd bucket on the D6. The basic Hystaway unit is now made for any of the three models with an attachment group for the specific model. Attachments are also made for fitting the unit to wide-gauge tractors and to those with additional attachments. Counter weight boxes are available for tractors used without bulldozers.

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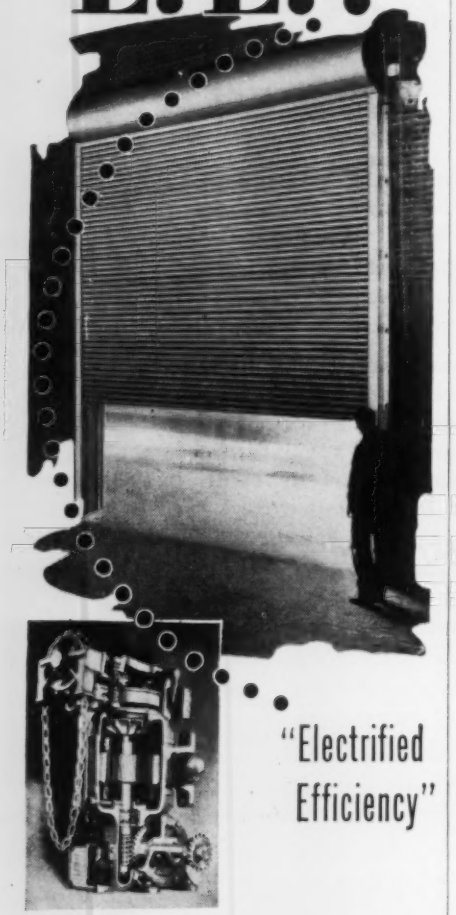

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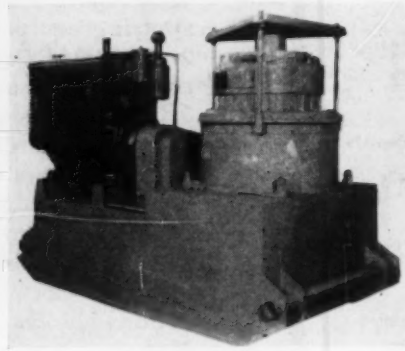
New AC Welders

THE HARNISCHFEGER CORPORATION of Milwaukee, manufacturer of P&H welding and materials handling equipment, announces a complete new line of AC arc welders.

Designed and built by P&H, the welders offer a number of unusual features. All models are supplied with "Dial-lectric" control. This simplified control entirely eliminates the need for moving coils or cores, worm gears, sprockets, and chain or lever adjustments. It is said by P&H that there is not a single moving part in the entire machine. Without cranks or plug-in stations, current selection is made simply by turning a single dial which requires but a three-quarter turn to cover the full welding range of the machine, from minimum to maximum capacity.

Self-Contained Portable Crushing Unit

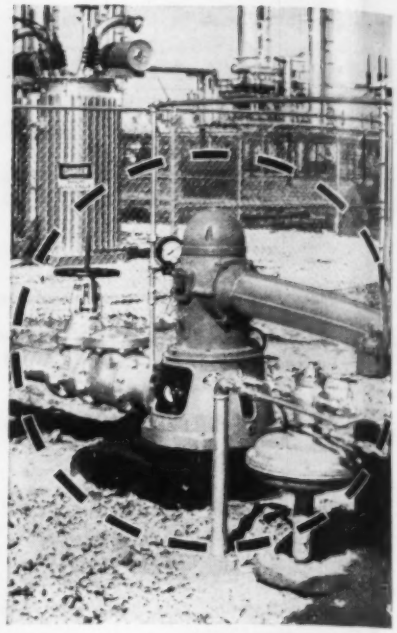


NORDBERG MANUFACTURING CO. of Milwaukee, Wis., announces production of a self-contained portable crushing unit consisting essentially of a 22″ Symons Cone Crusher, motor and drive, mounted on a welded steel supporting base and skid. It can be furnished with electric, diesel, or gasoline engine drive. Especially applicable to contractor type service, the unit is also efficient for semi or fully portable or stationary operations. Capacity of the 22″ Crusher varies from 20 tons per hour at $^3/_8$″ setting to 60 tons per hour at about $1^1/_2$″ setting. The packaged Cone Crusher Unit will be available also in larger sizes for those in need of greater capacity machines.

Concrete Termite Rotary Drill

CONCRETE TERMITE SALES COMPANY, 2301 Main St., Santa Monica, Calif., introduces a new drill, the Concrete Termite Rotary Drill, which depends on a new patented rotary pulverizing action rather than sharp cutting edges or hammer-like blows to drill straight, clean, true holes through any masonry-like material.

Concrete Termites are used with any electric drill. No pounding needed, no expensive air-compressor, no ear-shattering noise, no time lost on re-sharpening, no water necessary. Special patented features give the drills remarkable boring speed and long life.



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Aluminum Industrial Roofing

PRODUCTION OF A NEW, high-quality aluminum roofing material for industrial use, called Alcoa Industrial Roofing, has been announced to the building trades by the Aluminum Company of America.

The new product is a lightweight, heavy-duty specially formed material, developed to meet the demand of industrial builders for an aluminum roofing and siding specifically adapted to factories, warehouses, storage depots, hangars, and similar structures. The new industrial roofing will carry heavy loads and meet exacting requirements of building codes.

Combining high strength, exceptionally high resistance to industrial atmospheres, minimum maintenance and reduced roof load, Alcoa Industrial Roofing will have a covering width of 32 in., allowing for a side lap of $1\frac{1}{2}$ corrugations. It will come in standard five-foot through twelve-foot lengths, 0.032 in. thick.

Alcoa has also announced that industrial aluminum siding of the same alloy and lengths as the roofing has gone into production. This siding will have a coverage of 32 in., and will meet code requirements for siding materials.

World's Largest Crawler Tractor

PRODUCTION OF the world's largest, most powerful crawler tractor, the giant Allis-Chalmers HD-19 diesel, is now under way at the company's Springfield, Ill., Works. Engineered completely new throughout, this tractor has been designed and built to offer three major advantages to track type users.

By means of a three-stage hydraulic Torque Converter introduced into the power train of the tractor, the capacity for doing more work than conventional tractors is greatly increased. Both breakage and wear of the tractor and allied equipment are greatly reduced due to the cushion effect of the converter. Operating adjustments, maintenance points and major assemblies are so located and designed that the care and repair of the tractor can be accomplished with the least possible effort and loss of time. A wide, comfortable, easily adjusted operator's seat affords maximum visibility to front and rear. Hydraulically powered steering levers, adjustable brake pedals, self-energizing brakes, convenient arrangements of other controls, and a large, clear operator platform are features that combine to make the HD-19 the rugged, dependable tractor so necessary to the nation's onrushing construction program.

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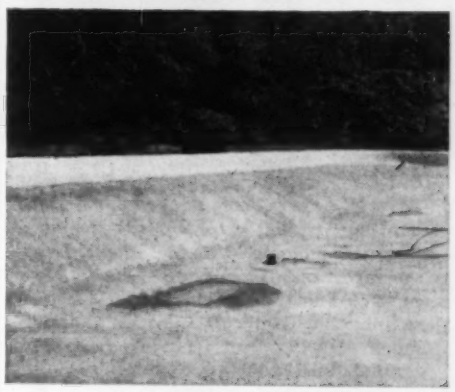

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New House-Moving Rig

UNPRECEDENTED PROBLEMS have been forced upon the house-moving contractor today with mile upon mile of houses to be moved to new locations to make room for municipal improvements and airports. To answer these problems, R. G. LeTourneau offers the huge house-moving rig called the Tournamover. This electrically operated machine is developed to pick up a house and carry it away. No jacking and blocking and no rollers and dollies are needed. Any type of understructure may be used. The Tournamover simply moves in, picks up the frame supporting the house, and rapidly moves off with the load to the new location.

Hard-Facing

A NEW METHOD for hard-facing by using a metallizing gun and Metco-Weld H, a "wire" composed of a powdered hard-facing alloy extruded with a plastic binder, is announced by Metallizing Engineering Co., Inc., Long Island City, N. Y. This Sprayweld method attains the previously difficult objective of applying smooth, uniform, relatively thin, hard coatings, in a highly practical and inexpensive manner.

During the spraying operation, the plastic binder is completely volatilized, and the deposit consists entirely of the metallic constituent. Subsequent fusing, with any fusing torch or with an attachment on a Metco metallizing gun, results in a coating alloyed to the base and physically and chemically identical to hard-facings of the same alloy applied by other methods.

The alloy used in Metro-Weld H is unique in that it possesses excellent resistance to abrasion and corrosion, and combines a low melting point with a long range of plasticity. Operation and advantages are explained by a newly issued bulletin.

New Beam Compasses

A COMPLETELY NEW TYPE of beam compasses featuring unusual compactness and rapid, efficient radius setting has been marketed by The Omicron Company, 532 W. Windsor Road, Glendale 4, Calif. It is a time saver for architectural and engineering drawing, for sheet metal layout and for woodworking. Applying the principle of the flexible-rigid type of retractable steel tape, instant radius settings up to 72" may be used. The tape retracts into a small, rugged die-cast case that may easily be held in the palm of the hand.

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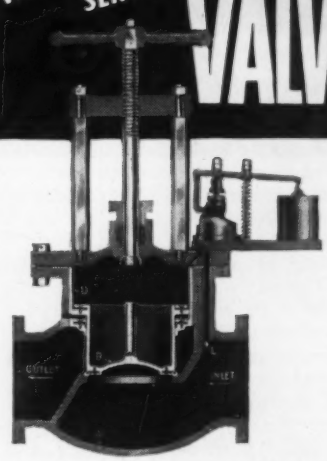

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FIFTH INGREDIENT IN CONCRETE—Dewey and Almy Chemical Company, Cambridge, Mass., has issued a comprehensive, illustrated bulletin of great interest to engineers and contractors. Darex Air Entraining Agent, the fifth ingredient in concrete, is a harmless, neutral, water-soluble compound, dark brown in color, and about the viscosity of water. Improved workability and plasticity of the concrete mix results from the inclusion of semi-microscopic bubbles of air which act as ball bearings to lubricate the mix. This improved plasticity permits substantial reductions in mixing water and gives better placeability to the concrete. Other major advantages derived from the use of Darex AEA are: greater durability, reduced bleeding, resistance to disintegrating effects of freezing and thawing, and minimization of green shrinkage and segregation.

ROTOSCOOP—The Dewatering Rotoscoop, manufactured by the Link-Belt Company, Chicago, Ill., is described in a new illustrated 4-page folder No. 2263 as being a sand dewatering device capable of recovering the available sand grains of sufficient fineness to meet specifications, and discharging the product dry enough to permit truck transportation, or mechanical conveying to and from storage. It is recommended also for treating other materials besides sand, and for saving special grain sizes which were formerly lost in the overflow water. The Rotoscoop is a self-contained machine, consisting essentially of a large circular steel tank, a slow-moving power-driven suspended rotating disc, a curved steel adjustable, renewable plow mounted in a stationary position above the rotating disc, and the necessary driving machinery mounted above the tank on the same steel supports from which the rotating disc is suspended.

PLASTER-MORTAR MIXER—A profit-building tool for small and large plaster and mason contractors, the Kwik-Mix 6-P Plaster-Mortar Mixer, is described in a new illustrated bulletin just published by the Kwik-Mix Company, Koehring subsidiary. Because the Kwik-Mix 6-P requires little attention as it mixes, plaster and mason contractors using a three- to four-man crew need no full-time mixer operator. On bigger jobs, the mixer will keep a crew of 30 men working at top speed. Saw-tooth mixing blades keep plaster threads from getting "balled," efficiently handle dry mortar. Air-cooled engine requires little attention. Full 6-ft batch is discharged in seven seconds through the big discharge door. Two simple controls start and stop mixing action, open and close discharge door.

STEAM SEPARATION—The Babcock & Wilcox Company has just released literature describing equipment for steam separation in boiler drums, scrubbers and Cyclone steam separators. Operation of the equipment is shown, together with illustrations of applications in several types of boiler units.

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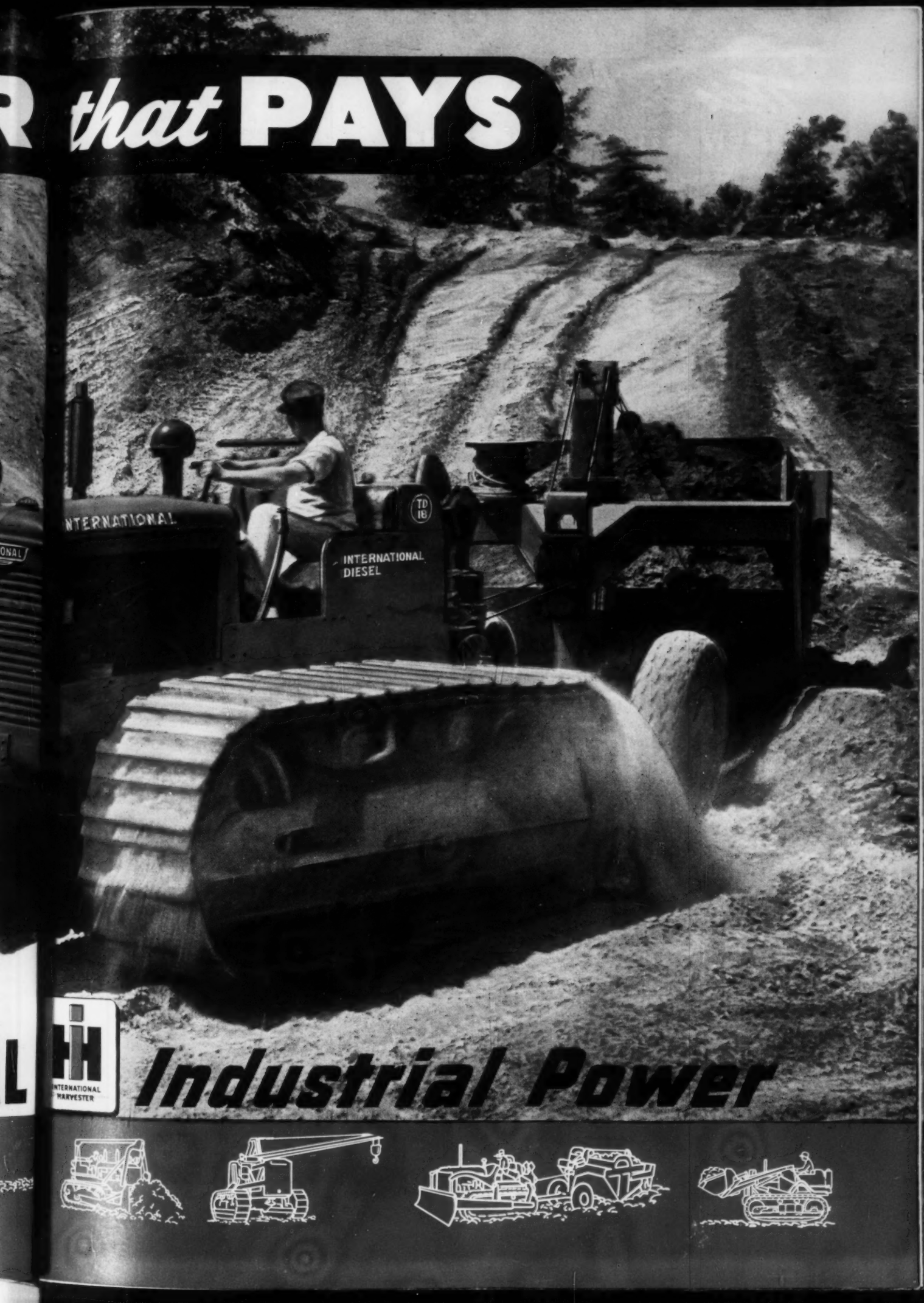
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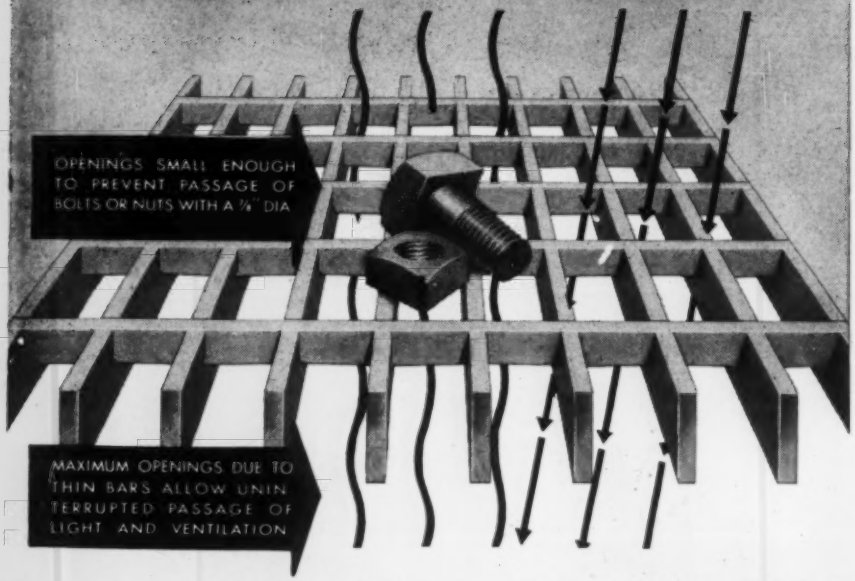
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Literature Available (Cont.)

THE CENTRILINE PROCESS—An attractive 28-page brochure entitled "The Centriline Process" has just been completed for the Centriline Corporation of New York for distribution to water works engineers and public officials interested in water supply. Numerous photographs and charts are used to illustrate centrifugal application of cement-mortar linings for water mains by the Centriline Process. In addition, the brochure includes other pertinent information such as: development of water main reconditioning, findings on the effectiveness of cement linings, coefficients before and after centrilining, the range of applicability, physical tests of cement-mortar linings, the reclamation of abandoned mains, the protection of new steel mains, A.W.W.A. Standard Specifications, and a list of contracts completed by the Centriline Process during the past twelve years.

FLOATLESS LIQUID LEVEL CONTROLS—The B/W Controller Corporation Birmingham, Mich., offers a comprehensive bulletin giving detailed information on the all-electric Floatless-Controls created by them. The bulletin discusses the following: operation, induction relays, multiple pump controls, electrode holders, electrodes, magnetic contactors and starters, AC combination starters, ice-free control, and application diagrams. Outstanding features attributed to the B/W Controls are: no floats used or required, no vacuum tubes used, no moving parts in the liquid, variations in levels from ¼ in. upward, unaffected by pressure, temperatures, acids or caustics and relay can be located any distance from the electrodes.

WHEEL TRENCHLINER—Parsons 200 Wheel Trenchliner, the new pipeline and drainage trencher produced by the Parsons Company, Koehring subsidiary at Newton, Iowa, is completely described in an illustrated bulletin just published. Thirty action pictures, detail photos and drawings show and explain features like the pivot wheel mounting, reported to simplify grade adjustments, particularly in drainage work. Specifications given indicate that the Trenchliner digs up to 5' 6" deep with a maximum digging width of 24". Gas or diesel power is available.

WATERPROOFING—A 12-page booklet is issued by the Stix Baer and Fuller Dry Goods Co., St. Louis, Mo., describing in simple language their process of waterproofing leaky basements, etc., from the inside by hydrostatic pressure. This process is absolutely guaranteed to make cellars bone dry and to do it economically.

MOTOR CONTROL—The Kinnear Manufacturing Company Columbus, Ohio has just issued a bulletin on motor control for use on rolling doors. This motor control is proving to be a real cost-saving device to many types of commercial industries. Push button door control, powered by electricity, has added to rolling door efficiency. The bulletin explains in detail the construction, operation, and specifications of types A and B motor control.